A DISSERTATION ON

HOSPITAL BASED MANAGEMENT OF SEVERE ACUTE MALNUTRITION CHILDREN AT A TERTIARY HOSPIAL

M.D (BRANCH VII)

PEDIATRIC MEDICINE

THE TAMILNADU DR.MGR.MEDICAL UNIVERSITY

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INSTITUTE OF CHILD HEALTH AND HOSPITAL FOR CHILDREN, MADRAS MEDICAL COLLEGE, CHENNAI.

CERTIFICATE

This is to certify that the dissertation titled, "**Hospital Based Management of Severe Acute Malnutrition Children at a Tertiary Hospital"** submitted by **Dr.Shruthi Purushotham** to the Faculty of Pediatrics, The Tamil Nadu Dr.M.G.R Medical University, Chennai, in partial fulfillment of the requirements for the award of M.D. Degree (Pediatrics) is a bonafide research work carried out by her under our direct supervision and guidance, during the academic year 2010-2013.

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DECLARATION

I, Dr. **ShruthiPurushotham,** solemnly declare that the dissertation titled "**Hospital Based Management of Severe Acute Malnutrition Children at a Tertiary Hospital**" has been prepared by me.

This is submitted to The Tamil Nadu Dr. M.G.R. Medical University, Chennai in partial fulfilment of the rules and regulations for the M.D., Degree Examination in Pediatrics.

Dr. ShruthiPurushotham

Place : Chennai

Date :

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Dr. ShruthiPurushotham

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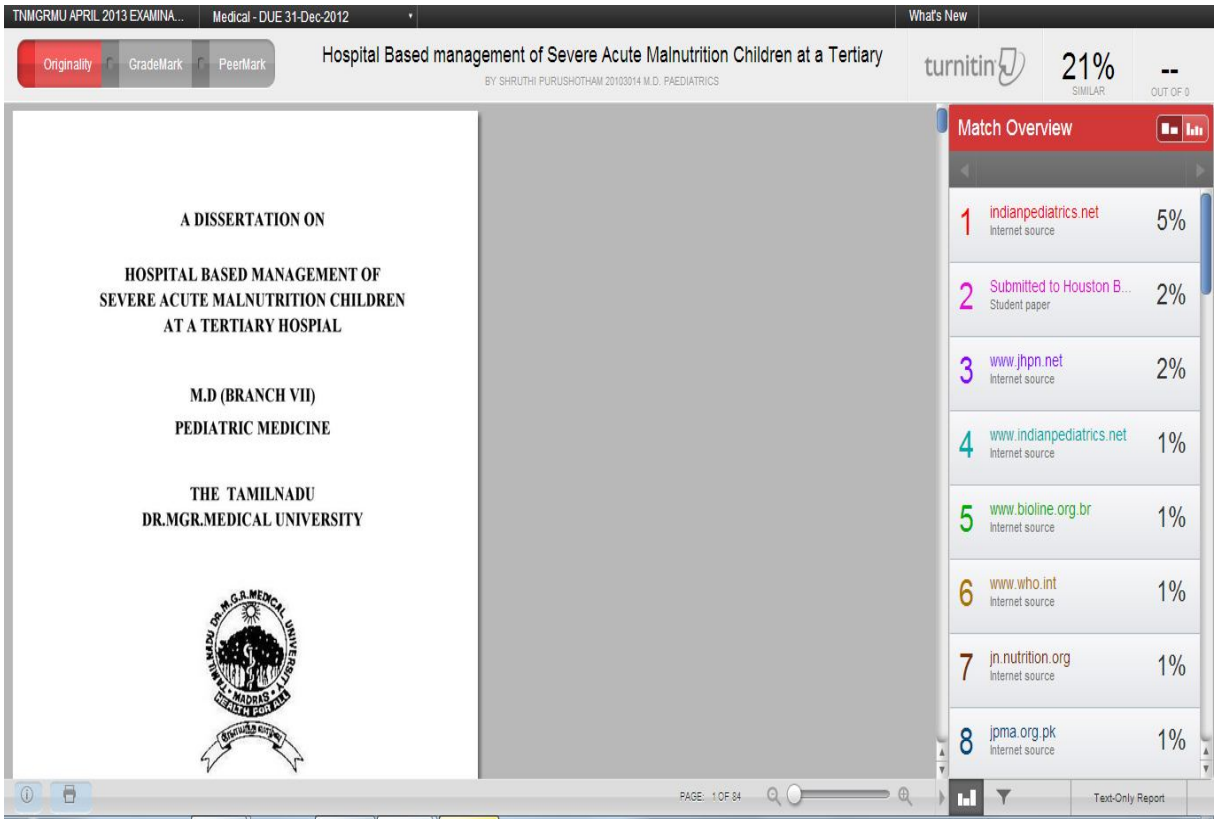
Dr.SHRUTHI PURUSHOTHAM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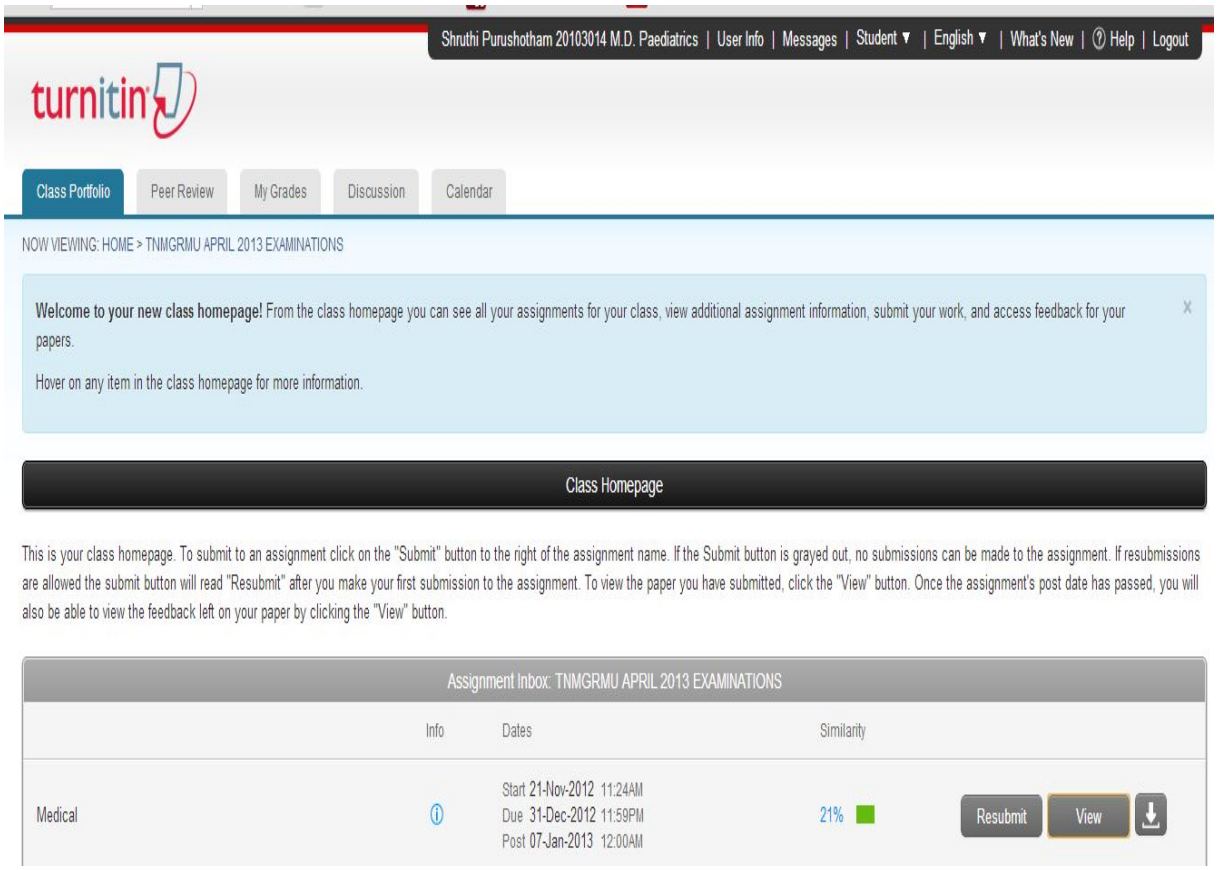
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INTRODUCTION

Severe acute malnutrition affects approximately 13 million children below 5 years of age and it causes death of 1- 2 million children every year due to various preventable causes. (1).

According to the National survey (NFHS-3, 2005-06), 43% of the children below 5 years of age are underweight, 48% of the children under five are stunted, 20% of the children below five years are wasted and about 6% of the children among them have severe wasting (<-3SD). These children who are severely wasted are termed as having Severe Acute Malnutrition (2).

In most developing countries, mortality rate in hospitals treating SAM remain at 20–30% and few of those requiring care actually have access to treatment (1).

Malnourished children do not respond to treatment in the same way as the children who are nourished well. They are more likely to die, with or without complications, than the well-nourished children. Hence special guidelines are needed for the treatment of these children (3).

To overcome this lacuna in the treatment of SAM children, WHO has devised guidelines for the management of the severely malnourished children after conducting studies in various parts of the world. But not much Indian studies have been conducted to find out the efficacy and feasibility of implementation of the WHO guidelines in a setting like ours.

Hence this study is done to find out the efficacy of the feeding guidelines given by WHO and also to find out the feasibility of implementation of these guidelines in our hospital setting

AIMS AND OBJECTIVES

1. To assess the efficacy of the feeding guidelines given by WHO and also to find out the feasibility of implementation of these guidelines in our hospital setting

2. To measure the weight gain in severely malnourished children receiving feeds as per WHO guidelines at a tertiary hospital

REVIEW OF LITERATURE

Under nutrition constitutes the most important health issue in India as in other parts of the world.

Under nutrition consists of stunting (chronic malnutrition), wasting (acute malnutrition) and micronutrient deficiencies (essential vitamins and minerals). As it is associated with high mortality and morbidity among children, there is an urgent need for implementation of various strategies to reduce its occurrence and consequence(2)

According to the National survey (NFHS-3, 2005-06) (2),

a. 43% of the children below 5 years are underweight (low weight for age)
b. 48% of the children under five are stunted (low height for age)
c. 20% of the children under five years are wasted (low weight for height). About 6% of children among them have severe wasting (<-3SD). These children who are severely wasted are termed as having Severe Acute Malnutrition.

In Tamilnadu 33.2% of the children below 3 years are underweight (2).

Under nutrition is the underlying factor in one third to half of all the children under five years who die due to preventable causes. Therefore specialised strategies are required for the identification, specialised treatment and preventive measures to reduce the mortality and morbidity due to malnutrition (2, 3).

UNDERSTANDING MALNUTRITION

Malnutrition is a term that refers to under nutrition due to reduced consumption, poor absorption or due to loss of nutrients. It also includes over nutrition which in turn is due to excessive intake of specific nutrients.

Malnutrition can be measured in young children by weighing them and /or comparing their height with the" reference population" who are supposed to have grown well. Such use of measurements of the dimension of the human body is known as Anthropometry.

Anthropometry is a tool used to measure the nutritional status of a child or a population. It is inexpensive and non-invasive. The most frequently used anthropometric indices are:

a) Weight-For-Age (WFA).

b) Length-For-Age or Height-For-Age (HFA).

c) Weight-For-Length or Weight-For-Height (WFH).

d) Mid upper arm circumference.

These three indices i.e., weight-for-age, height/length-for-age and weight-for-height/length are useful in the identification of the following nutrition conditions: underweight, stunting and wasting. Each of these three nutrition indicators is expressed in the form of standard deviation units (Z-scores) taken from the median of the reference population based on which under nutrition may be further classified as moderate or severe.

The classification of underweight is done depending on the weight for the given age which is a composite measure of stunting and wasting. This condition can result from either chronic or acute malnutrition, or both. Underweight is the most frequently used basic indicator of the health status of a population as weight can be measured easily. There is much evidence which have shown that severely malnourished children have increased mortality. Under

weight children have a weight-for-age Z-score at least two standard deviations (-2SD) below the median in the World Health Organization (WHO) Child Growth Standards.

Failure to gain expected height/length when compared to their healthy counterparts indicates a sign of stunting. Stunting indicates that there is a retardation of the linear growth which can be due to reduced intake of nutritious diet over a long period of time or can also be due to recurrent infections. It may be exacerbated by recurrent and chronic illness. Stunting is an indicator of growth failure in the past. Various causes for stunting include inadequate nutritional food intake over a long period of time, recurrent infections, faulty feeding techniques and poverty.

Stunting often results in delayed psycho-social and cognitive development and poor school performance. This in turn affects economic productivity at national level. If a child has the height for age score less than – 2 SD below the median of the WHO growth standards, he is considered to be stunted.

Wasting is indicative of a recent failure to receive adequate nutritious diet. It can also occur due to the recent diarrhoeal illness or due to various other acute illnesses. Various causes of wasting

comprise of inappropriate feeding techniques, inadequate food intake, disease and infection and most often a combination of the above mentioned factors. A wasted child has a weight-for-height Z-score of two standard deviations (-2SD) below the median for the WHO Child Growth Standards.

Severe Acute Malnutrition (SAM)

Severe acute malnutrition is defined by very low weight-for-height/length (Z- score below -3SD of the median WHO child growth standards), a mid-upper arm circumference <115 mm, or by the presence of nutritional oedema (2, 3)

Severe acute malnutrition increases significantly the risk of death in children less than 5 years of age. SAM can indirectly increase the case fatality rate in children suffering from various common childhood illnesses thereby leading to their premature death (1, 3). Children who are severely wasted are 9 times more likely to die than well-nourished children.

MANAGEMENT OF SAM CHILDREN

WHO has given guidelines for the inpatient management of children with severe acute malnutrition (4, 5, 6, and 7).These special guideline are required as these severely malnourished children have various physiologic and metabolic changes due to the adjustment of the body to the periods of malnutrition (3).

These guidelines are divided into five sections:

a) General principles for routine care (the'10 steps')

b) Emergency treatment of shock and severe anaemia

c) Treatment of associated conditions

d) Failure to respond to treatment

e) Discharge before recovery is complete

A.GENERAL PRINCIPLES FOR ROUTINE CARE (the'10 Steps') (3)

There are ten essential steps:

1. Treat/prevent hypoglycaemia

2. Treat/prevent hypothermia

3 .Treat/prevent dehydration

4 .Correct electrolyte imbalance

5. Treat/prevent infection

6. Correct micronutrient deficiencies

7. Start cautious feeding

8. Achieve catch-up growth

9. Provide sensory stimulation and emotional support

10. Prepare for follow-up after recovery

The above steps can be carried out in 2 phases-

1) An initial stabilisation phase

2) A longer rehabilitation phase

These treatment guidelines are same for the treatment of children with both marasmus and kwashiorkor.

After the initial stabilization phase, during the rehabilitation phase child is started with feeds as per WHO recommendations.

In this study, the children with severe acute malnutrition will be treated based on the WHO Guidelines using cereal based formulas, which are given both as a starter as well as a catch up formula. This

formula is easy to prepare due to its locally available constituents such as powdered puffed rice, milk, sugar and oil and the constitution of each ingredient would be described later.

The main aim of the study is to find out the rate of the catch up growth in severely malnourished children receiving feeds as per WHO guidelines.

The outcome is said to be significant if there is a Weight gain of >10gm/kg/day.

1. Raja Srisiwan Mamadi et al (2001- 2005) conducted a retrospective study to evaluate for the catch up growth in 309 SAM children treated using energy dense local. These children were given diet based on the WHO recommended calorie and protein and also local foods were chosen so that, the same can be continued at home. Initially a calorie of 100Kcal/kg/day was given which was gradually increased to 170-220Kcal/kg/day and multivitamin-multi mineral mix was also given. Results showed that the mean rate of weight gain calculated for the total duration of the hospital stay in the entire sample was 5g/kg/day, 8% of them did not gain weight, 44% of the children had poor catch up growth (<5g/kg/day), 35% of the children had

moderate catch up growth (5-10g/kg/day) and 12% had rapid catch-up growth (>10g/kg/day). Also the baseline WHZ score had a significant negative relationship to the weight gain. They concluded saying that the diet based on local energy dense foods was found to be suitable for the nutrition rehabilitation of severely malnourished children though the rate of weight gain was moderate and also that milk based food were better compared to the vegetable based ones (8).

2. Deepak Patel et al (2006-2008) conducted a prospective study on 34 SAM children to evaluate the feasibility and outcome of home-based rehabilitation of SAM children. SAM children with complications were admitted to hospital and others with no complication were managed at home with home based diets and they were followed up regularly. The results showed that of the enrolled 34 children, 19 children were admitted in hospital and 15 children were sent home after initial assessment in hospital. Five did not clear the initial stabilization phase (2 died, 3 left hospital). Finally 29children qualified for home based rehabilitation out of which 26 completed 16 week follow up. During the home based management phase, the reported mean

(±SD) calorie intake increased from 100 (±5) kcal/kg/d at entry point to 243 (±13) kcal/kg/d at 16 weeks (*P*=0.000).Similarly, reported protein intake increased from 1.1 (±0.3)g/kg/d to 4.8 (±0.3) g/kg/d (*P*=0.000). During hospital stay (*n*=19), children had weight gain of 9.0 (±5.3) g/kg/d, while during home based follow up (*n*=29), weight gain was 3.2(±1.5) g/kg/d only. During home based rehabilitation, only3 (11.5%) children had weight gain of more than 5 g/kg/d by the end of 16 weeks. Weight for height percentage increased from an average (±SD) of 62.9% (±6.0%) to80.3% (±5.7%) after the completion of 16 weeks (*P*=0.000). Thirteen (45%) children recovered completely from malnutrition achieving a weight for length of >80%whereas 15 (51.7%) recovered partly achieving weight for length >70%. There was no death during the home stabilization. They concluded that Home based management using home prepared food and hospital based follow up is associated with sub-optimal and slower recovery (9).

3. Azara Sneha Singh et al (2008) conducted a randomised open controlled trial involving 118 school children in the age group of 18-59 months with a weight for age < -2SD, who were

randomly assigned to either receive a locally produced energy-dense RUTF, administered in pre-schools by teachers and compared to the current standard of care, i.e. to teach care givers to prepare a fortified cereal-milk supplement (High-Calorie Cereal Milk; HCCM),and advised 2 x 100 ml feeds per day along with continuation of the family feeds in both groups and the effectiveness of a locally made ready-to-use therapeutic food (RUTF) in decreasing mild to moderate malnutrition was evaluated. The results showed that the Mean (SD) weight gain at 3 months was higher in the RUTF group: RUTF (*n*=51): 0.54 kg; (SE =0.05; 95% CI = 0.44 – 0.65) *v/s* HCCM (*n*=45): 0.38 kg;(SE = 0.06; 95% CI = 0.25 – 0.51), *P* = 0.047. The weight gain per kilogram of body weight was directly proportional to the severity of malnutrition. Thus they concluded that Community-based treatment showed weight gain in both groups and the gain being higher with RUTF (10).

4. Md. Iqbal Hussain et al (2005-2006) conducted a study to provide evidence-based results for policy-makers in the management of children with severe acute malnutrition and complications in Bangladesh, using a protocolized treatment

based on the guidelines of WHO. 171 SAM children were managed in two phases: (a) acute phase and (b) nutrition rehabilitation phase. The initial treatment in the acute phase began with admission to the hospital and lasted until the child's condition was stable and appetite had returned, which usually took 3-7 days. The principal tasks during initial treatment included treatment and prevention of hypoglycaemia, hypothermia, dehydration, electrolyte imbalance, shock, and treatment of infections and other problems, including vitamin A deficiency, severe anaemia, and heart failure. The results showed that the mean gain in weight was 10.6 g/kg per day in non-oedematous children. While oedematous children had a mean weight loss of 1.9 g/kg per day, and the change of weight was observed similar in both girls and boys (p=not significant). Loss of weight was observed in 19.8%, no change in weight was observed in 3.7%, and gain in weight was observed in 76.5% of the treated children. If the rate of gain in weight is <5 g/kg per day, the progress is considered poor; if it is 5-10 g/kg per day, it is considered moderate; if it is >10 g/kg per day, it is considered good (12, 13). At the CMCH, 14.7% of the children demonstrated poor gain in weight, 30.9% moderate, and the

remaining 30.9% demonstrated good gain in weight. Thus they concluded that within the limitations in the health infrastructure, effective implementation of the WHO guidelines is feasible when the available staff members are trained and supported to follow the guidelines (11)

5. Eleanor Oakley et al (2008-2009) conducted a multicentre study (14, 15, 16, 17) in the southern parts of Malawi comparing the RUTF with 25% milk and RUTF with 10%milk and 15% soy. SAM children were randomly assigned with equal probability to either 25% milk RUTF or 10% milk RUTF as home-based therapy for up to 8 wk. They found out that recovery among children receiving 25% milk RUTF was greater than children receiving 10% milk RUTF, 64% compared with 57% after 4 wk, and 84% compared with 81% after 8 wk ($P < 0.001$). Children receiving 25% milk RUTF also had higher rates of weight and height gain compared with children receiving 10% milk RUTF. Thus they concluded that treating children with SAM with 10% milk RUTF is less effective compared to treatment with the standard 25% milk RUTF (14).

6. Akram D S et al (2006-2007) conducted a prospective cohort study with an aim to improve nutrition of malnourished children in the community, using home based treatment. 24 SAM children were provided with high density diet (HDD) and daily weight, amount of HDD consumed and complications were recorded. Results showed that among 24 SAM children eleven of them (45.8%) reached - 1SD at the end of 3 months while 10 patients (41.6%) took 4 months. Twenty two patients (91.6%) were at the median weight for height by the end of 5 months. Thus they concluded that home based treatment with locally available foods could be used successfully to rehabilitate severely malnourished children (19).

MATERIALS AND METHODS

Study Design

Descriptive and observational

Study Place

General medical wards and Nutrition ward, Institute of child health & hospital for children.

StudyPeriod

November2010 to October 2012.

Case Definition

Severe Acute Malnutrition has been defined according to the WHO guidelines in children between 6months to 5 years as

a. Weight for height/length <-3 z score of median of WHO child growth standards or less than 70% of the expected for the given age and sex
b. Bipedal oedema
c. Severe visible wasting
d. MUAC<11.5cm

Inclusion criteria

Children from the age of 6month to 5years with severe acute malnutrition admitted in the medical wards of Institute of Child Health and Hospital for children during the study period were eligible for inclusion.

Exclusion criteria

Children having other diseases which are known to cause severe malnutrition such as-

a. Cerebral palsy
b. Congenital heart disease
c. Hemolytic anemia
d. Malignancies
e. Metabolic & malabsorption syndromes
f. Chromosomal malformations
g. Chronic renal failure
h. Chronic liver disease
i. Collagen vascular disorders
j. Endocrine causes
k. Other causes of edema such as nephrotic syndrome were excluded.

Sample size and Sampling technique

100 consecutive SAM children admitted in the medical wards of Institute of Child health and hospital for children were included in the study.

Ethics

Written informed consent was obtained from the parents and Institution review board clearance was obtained.

Manoeuvre

SAM children who got admitted to the hospital medical wards were stabilized initially and the associated complications such as hypothermia, hypoglycemia, dehydration, electrolyte disturbance and infections were managed.

Detailed clinical examination including anthropometric measurements, general physical examination & systemic examination was done. Weight was measured by the same person daily and it was recorded with minimal clothing on an electronic weighing scale to the

nearest 5 g. Length was recorded using an infantometer to the nearest 0.5cm, and head, chest and mid-upper arm circumference were recorded using non-stretchable measuring tape using standard Techniques to the nearest 0.1cm (27).

Various investigations such as hemoglobin, blood sugar, albumin, serum electrolytes, blood culture, urine routine & culture, chest x ray, HIV and other relevant investigations were done.

After the initial stabilization phase, during the rehabilitation phase child was started with feeds as per WHO recommendations. Children were fed as early as possible and frequent, small feeds with low osmolality and low lactose were given. In breast fed children, breast feeding was continued and if the child was unable to take the entire amount of feeds orally, nasogastric tube was used till the child was able to take 75% of all feeds orally.

Initially 130ml/kg/day of liquids (100ml/kg/day if there was associated severe oedema) was given with a calorie content of 100Kcal/kg/day and protein of 1-1.5gm/kg/day was given.

Mothers were demonstrated the methods of preparation of the feeds and the feeding, preparation of feeds were supervised by the post graduate in charge of that SAM child.

Starter Formula

Cereal based Starter formula as given by the FIMNCI guidelines (26) was given uniformly to all SAM children as feeding with cereal based formula was associated with less incidence of diarrhoea.

Starter formula was started as soon as possible and was continued for 2 to 7 days until the child was stabilized, with no restriction of daily oral intake. Starter formula provided 75kcal/100ml & 0.9gm of proteins/100ml. The composition of the cereal based starter formula is as follows.

Diet contents per (100ml)	**F-75 starter formula (cereal based)**
Cow's milk(ml)	30
Sugar (1 tsp.)	1
Cereal (powdered puffed rice)(1 tsp.)	¾
Vegetable oil (1 tsp.)	½
Water (make up to 100ml)	100
Energy (Kcal)	75
Protein (g)	1.1
Lactose (g)	1.2

The child was fed with cup and spoon by the mother. If it was unable to take 75% of the 2-3 consecutive feeds orally then NG tube feeds were given until the child is able to take 2 consecutive 75% of

the total feeds orally. Breast fed children were encouraged to continue breast feeding.

24 hour food intake and output chart was recorded in the ward. If there was vomiting/significant diarrhoea, or poor appetite, 2-hrly feeds were continued. If there was little or no vomiting/diarrhoea less than before and most feeds were consumed, the child was given 3-hrly feeds. After a day on 3-hrly feeds, if there was no vomiting, occasional diarrhoea, and most of the feed was consumed, 4hourly feeds was started.

Recommended schedule with gradual increase in feed volume is as follows

Days	**Frequency**	**volume/kg/day**
1-2	2hrly	130ml
3-5	3hrly	130ml
6 onwards	4hrly	130ml

Preparation of the feeds

Sugar and oil was mixed first and then fresh milk was added to it. Boiled and cooled water was added up to 100ml, stirring all the time. This mixture was whisked vigorously so that oil did not separate out.

Monitoring

Children were monitored continuously and the intake and output was recorded in a 24 hour intake output chart and the daily weight was recorded in a weight chart displayed below. Also following parameters were recorded daily

a. Amounts of the feed offered and left over
b. Stool frequency and consistency
c. Vomiting
d. Daily body weight.

Catch Up Growth

When the child's appetite returns as seen by finishing most of the fourth hourly feeds of the starter formula and when most or all of the oedema is gone, child was switched over to catch up formula.

Catch up formula is used to rebuild wasted tissues. It contains more calories and protein.

The catch up formula was started gradually replacing the starter formula for the initial two days. Cereal based formula was given which contained 100 kcal/100ml and 2.9 g of protein per 100ml.

On the 3rd day each successive feeds were increased by 10ml as long as child was finishing feeds. The feeds were increased until some amount of it remained uneaten. The child could take feeds even up to 200ml/kg/day.

Breast feeding was continued while on catch up formula.

Cereal based catch up formula was used in this study and its composition as follows

Diet contents (per100ml)	**F-100 catch up (cereal based) example**
Cow's milk /toned dairy milk(ml)	75
Sugar (tsp.)	½
Cereal (puffed rice) (tsp.)	2
Vegetable oil (tsp.)	½
Water (make to 100 ml)	100
Energy (Kcal)	100
Protein (g)	2.9
Lactose (g)	3

After a gradual transition, frequent feeds, unlimited amounts consisting of 150–220 kcal/kg/day, 4–6 g of protein/kg/day was given

Sensory stimulation

During rehabilitation, loving care, a cheerful stimulating environment and a structured play therapy for 15-30 min a day was given to the SAM children. Physical activity was encouraged as soon as the child was well. Mothers were made to involve in the care and stimulation of the SAM children.

24-Hour Food Intake Chart

Ward _____

Name _____ Hospital number _____

Age _____ Weight _____ Date of Admission _____

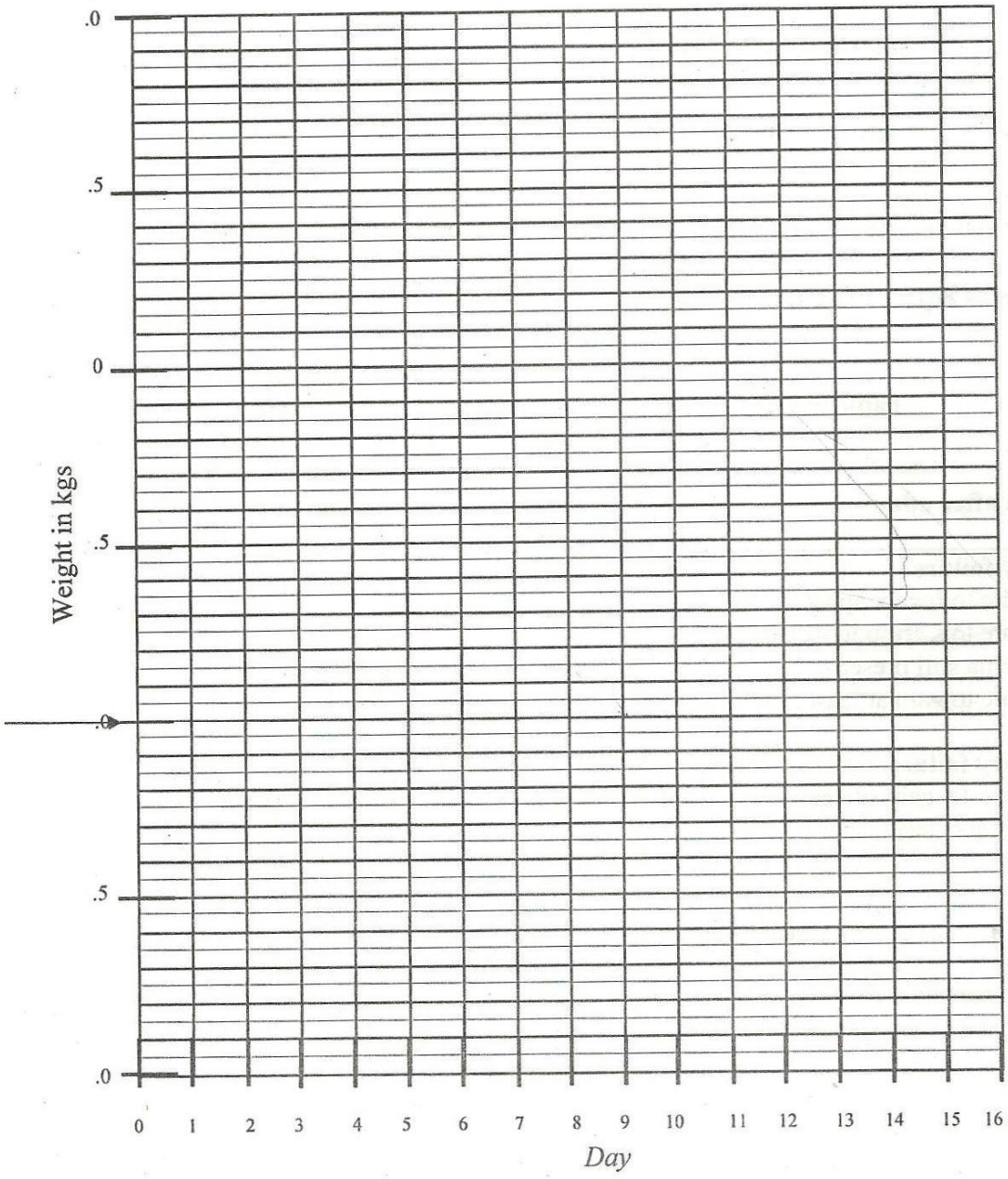
Date ..... Feed: ..... feeds of ..... ml each = ... ml per day

Time	Type of feed	Volume offered (ml)	Volume left in cup (ml)	Amount taken by child (ml)	Vomit estimate (ml)	Watery diarrhoea (Yes/No)
Totals:				Sub-total		Total taken in 24 hrs

Blank Weight Chart

Name: _____ Weight on admission_____

Age: _____ Weight on discharge_____



All children with severe malnutrition admitted were assumed to have an infection and broad spectrum antibiotics were given as per the WHO guidelines. If a specific infection was identified (such as Shigella) the appropriate antibiotics were given.

Treatment of the Associated Conditions

Antimalarial was given when blood smear was positive for malarial parasites. ATT was started if tuberculosis was diagnosed or strongly suspected.

HIV was suspected if the child also had other problems like persistent diarrhoea, oral thrush, pneumonia, parotid swelling or generalized lymphadenopathy and was started on ART as indicated.

In the presence of severe anaemia whole blood or packed cell transfusion was given if Hb was < 4g/dl or Hb was between 4-6 g/dl and child had respiratory distress.10ml/kg slowly was given over 4-6 hours and Inj. Frusemide 1mg/kg was given at the start of the transfusion. Blood transfusion was not repeated within 4 days.

If there were eye problems (keratomalacia) due to vitamin A deficiency, in addition to vitamin A doses ciprofloxacin eye drops was

instilled 2-3 hourly and atropine eye drops 3 times a day for 7-10 days. Eye was covered with pad and bandage.

For skin lesions, child was bathed or the affected areas were soaked for 10 min in 1% potassium permanganate solution and gentian violet or nystatin cream was applied if available to skin sores and barrier cream (zinc cream) to the raw areas.

Persistent diarrhoea: Diarrhoea is common in severe malnutrition but with cautious refeeding, it should subside during the first week. If the children had persistent diarrhoea, they were screened for non-intestinal infections and treated appropriately. Breast feeding was continued and feeds with low lactose were given initially and subsequently it was changed to lactose free options if diarrhoea persists.

Micronutrients

All SAM children were given the following micronutrients during their stay in our hospital. Oral Vitamin A was given in the form of capsules available from our pharmacy. Folic acid, zinc and iron tablets were also given to the children as per the WHO

recommendation which were supplied from our pharmacy itself. Rest other micronutrients were given to the children in the form of multivitamin multi mineral syrup (Syrup Fortes B) which consisted of all the constituents as advised by the WHO protocol oral vitamin A single dose was given.

Vitamin A orally was given in a single dose as given below:

- < 6 months: 50,000 IU (if clinical signs of Vitamin A deficiency was present).
- 6-12 months: 1 lakh IU.
- Older children: 2 lakh IU.
- Children < 8kg irrespective of age received 1 lakh IU orally.

Same dose was given on Day 0,1 and 14 if there was clinical evidence of vitamin A deficiency.

Other micronutrients were given daily for at least 2 weeks:

- Multivitamin supplement (contained vitamin A, C, D, E and B12, vitamin B-complex) twice the recommended daily allowance was given.
- Folic acid: 5mg on day 1, then 1mg/day.
- Zinc: 2mg/kg/day.
- Copper: 0.3mg/kg/day
- When weight gain commenced and when there was no diarrhoea 3mg of iron/kg/day was added.

Failure of weight gain was considered when there was,

- Failure to gain at least 5 gm/kg of body weight per day during rehabilitation for 3 successive days
- If the weight gain was <5 g/kg/day, we tried to find out whether this occurred in all cases being treated or
- Whether this occurred in specific cases

Monitoring of progress during treatment

If there was a good weight gain i.e. > 10 g/kg/d, the same treatment was continued (28, 29).

If there was a moderate weight gain i.e. 5-10 g/kg/day, the child was examined for any associated infection and if feeding was faulty, it was corrected.

If there was a poor weight gain i.e. <5g/kg/d, the child was assessed for - Inadequate feeding, untreated infection, HIV infection, psychological problems.

Criteria for discharge

SAM children were discharged if they satisfied the following criteria Consistent weight gain at least 5gm/kg/day for 3 consecutive days.

- Had lost edema.
- No infections
- Immunization programme started.
- Eating 120-130kcal/kg/day & has a good appetite, receiving adequate micronutrients.

- Weight for height reached 1 SD of median of WHO standards.
- Mothers were counseled to ensure proper feeding & for regular follow up.

The SAM children were followed up at nutrition OPD at the end of 1st week, 2nd week and 4th week following discharge. Mothers were advised to give home based energy dense food with a total calorie of approximately 150kcal/kg/day and proteins of 2-3 gm/kg/day. On each visit a complete 24 hour recall method of diet history was taken. Weight, height, Mid upper arm circumference, head circumference, chest circumference were measured as mentioned before. Those children with any complaints were readmitted and treated. Those children who achieved a weight gain of >5gm/kg/day during follow up were said to have a good outcome.

OBSERVATIONS AND RESULTS

Among 100 SAM children admitted at ICH and HC, 18% were found to have a poor outcome (<5gm/kg/day), 46% of them were found to have a moderate outcome (between 5 to 10gm/kg/day) and 36 % were found to have a good outcome (>10gm/kg/day). The mean weight gain in this study was found to be 8.5gm/kg/day. The mean weight gain was found to be 2.8gm/kg/day in the children with poor outcome, 7.4gm/kg/day in those with moderate outcome and a mean weight gain of 12gm/kg/day in those with good outcome.

Outcome	Frequency	Percent
Poor	18	18.0
Moderate	46	46.0
Good	36	36.0
Total	**100**	**100.0**

Table 1 showing the outcome dependent data where in 18% had poor outcome, 46% had moderate outcome and 36% of them had good outcome.

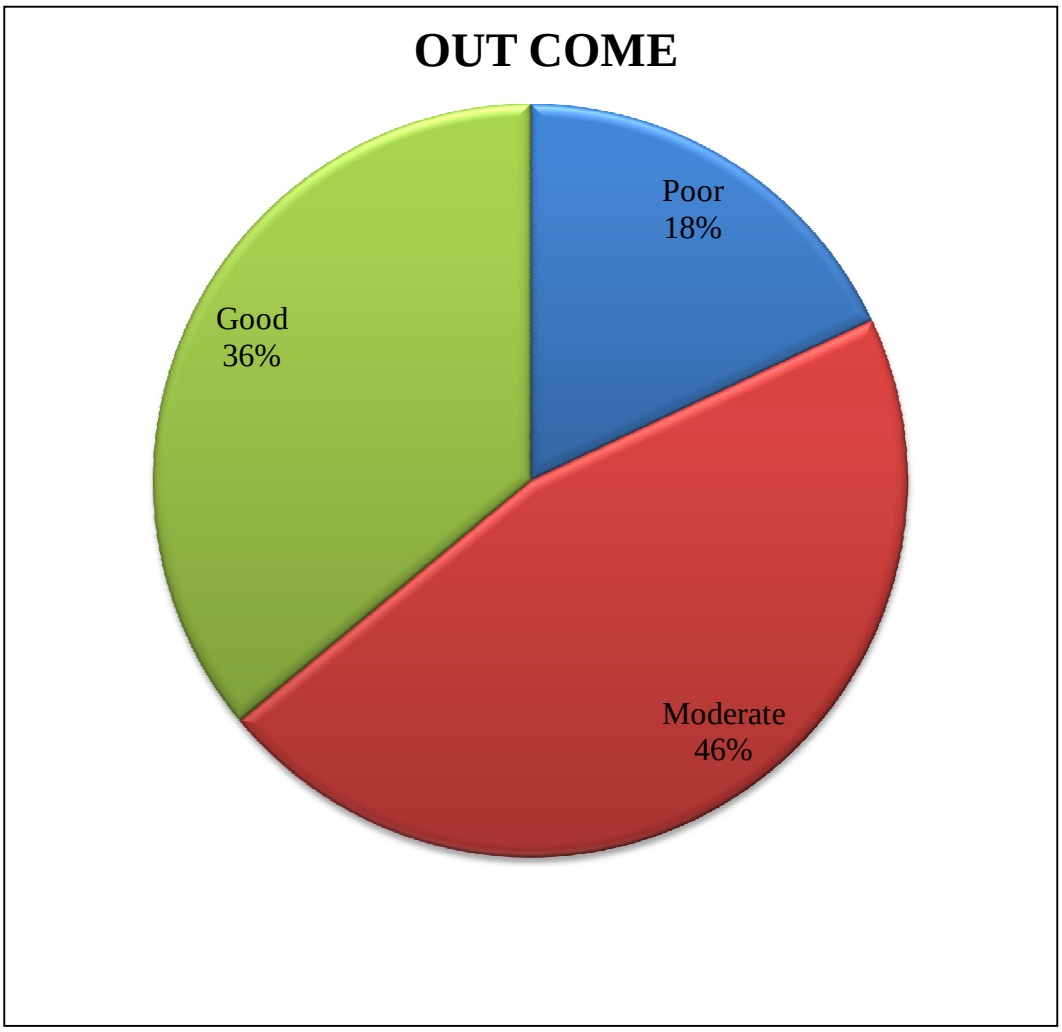


Chart Showing Outcome wise Data

Outcome	Mean	N	Std. Deviation
Poor	2.8362	19	2.59336
Moderate	7.4286	38	1.42584
Good	12.0960	43	3.41225
Total	**8.5630**	**100**	**4.37400**

Table 2 showing the mean weight gain in each group divided based on the outcome. Mean weight gain was found to be 8.5gm/kg/day

Outcome	Frequency	Percent
No Improvement	18	18.0
Moderate Improvement	82	82.0
Total	**100**	**100.0**

To analyze the data, SAM children were divided depending on the outcome variable of weight gain as those with no improvement who accounted for 18% of the total cases and as those with moderate improvement which accounted for 82% of the children**.**

	Diagnosis	Poor	Mode rate	Good	Total
Diarrhoea	Count %within diagnosis % GP 1	**0** **0** **0**	**10** **55.%** **21.7%**	**8** **44.4%** **22.2%**	**18** **100%** **18%**
Pneumonia	Count %within diagnosis % GP 1	2 16.7% 11.1%	7 58.3% 15.2%	3 25% 8.3%	12 100% 12%
Others	Count %within diagnosis % GP 1	11 20.8% 61.1%	23 43.4% 50%	19 35.8% 52.8%	53 100% 53
Malnutrition	Count %within diagnosis % GP 1	3 33.3% 16.7%	2 22.2% 4.3%	4 44.4% 11.1%	9 100% 9%
Diarrhoea+ Malnutrition	Count %within diagnosis % GP 1	0 0 0	3 60% 6.5%	2 40% 5.6%	5 100% 5%
Diarrhoea+ Pnemonia	Count %within diagnosis % GP 1	2 100% 11.1%	0 0 0	0 0 0	2 100% 2%
Diarrhoea+ Pnemonia+ Malnutrition	Count %within diagnosis % GP 1	0 0 0	1 100% 2.2%	0 0 0	1 100% 1%
TOTAL	**Count** **%within diagnosis** **% GP 1**	**18** **18%** **100**	**46** **46%** **100%**	**36** **36%** **100%**	**100** **100%** **100%**

Pearson Chi-square P value=0.09, not significant

Table 3: Showing Diagnosis for which SAM children where admitted.

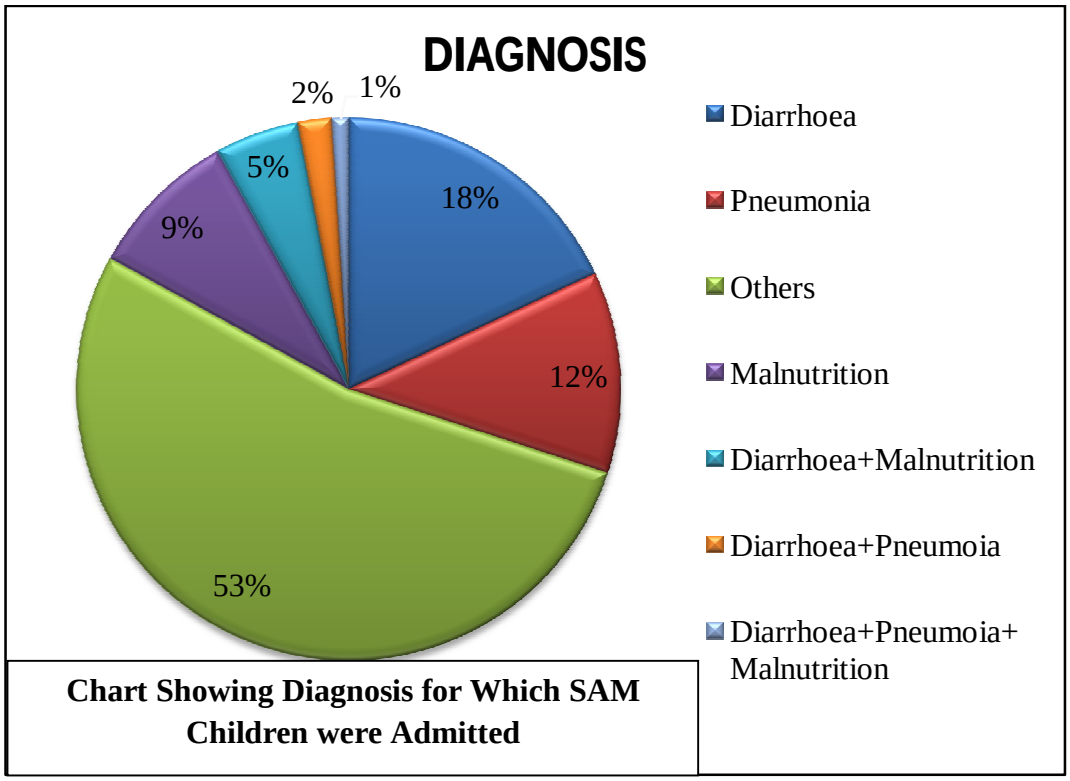


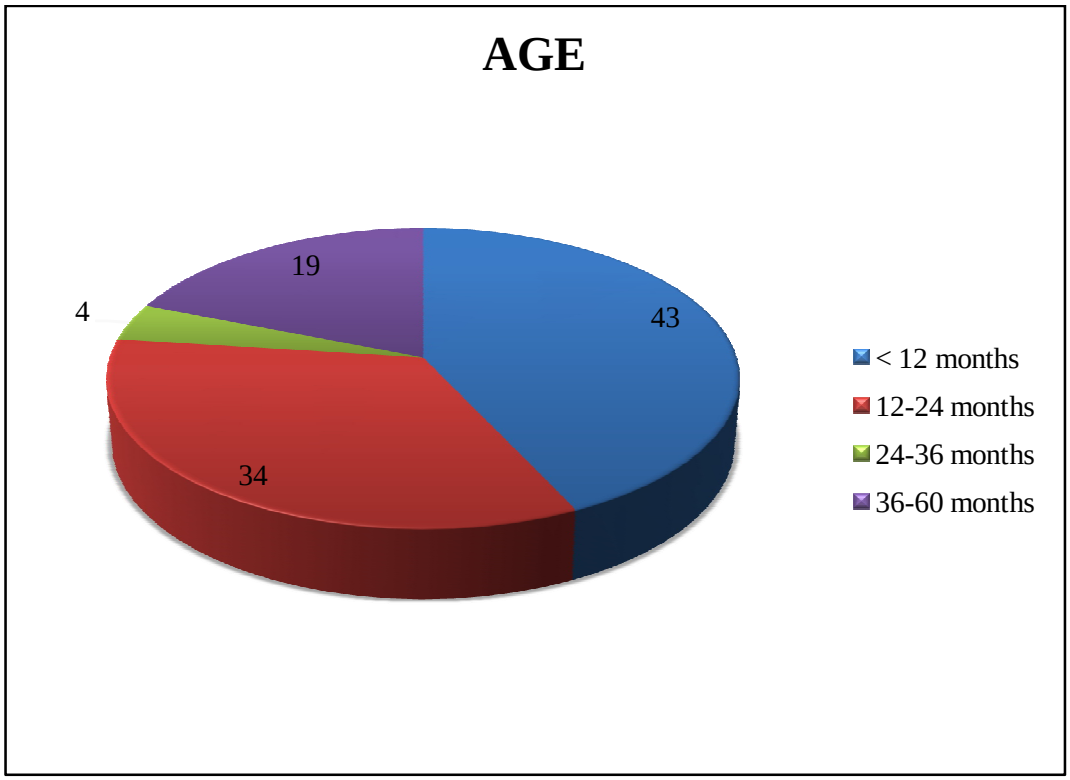
Chart Showing Diagnosis for Which SAM Children were Admitted

Out of the 100 SAM children, 18 of them were admitted for diarrhea, 12 of them had pneumonia, another 9 of them were admitted for malnutrition (reduced weight gain), 5 of them had diarrhea and malnutrition, 2 of them had diarrhea and pneumonia, 1 child had diarrhea, pneumonia and malnutrition as the cause for admission and rest 53 of them were admitted with other complaints such as acute CNS infection, viral fever, typhoid etc. Pearson Chi Square was applied and a P value 0f 0.09 was obtained which is not statistically significant.

		wtgnkgdaygp1			
		Poor	**Moderate**	**Good**	**Total**
< 12 months	Count	6	16	21	43
	% within age group	14.0%	37.2%	48.8%	100.0%
	% within wtgnkgdaygp1	33.3%	34.8%	58.3%	43.0%
12-24 months	Count	5	19	10	34
	% within age group	14.7%	55.9%	29.4%	100.0%
	% within wtgnkgdaygp1	27.8%	41.3%	27.8%	34.0%
24-36 months	Count	0	2	2	4
	% within age group	.0%	50.0%	50.0%	100.0%
	% within wtgnkgdaygp1	.0%	4.3%	5.6%	4.0%
36-60 months	Count	7	9	3	19
	% within age group	36.8%	47.4%	15.8%	100.0%
	% within wtgnkgdaygp1	38.9%	19.6%	8.3%	19.0%
Total	Count	18	46	36	100
	% within age group	18.0%	46.0%	36.0%	100.0%
	% within wtgnkgdaygp1	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square P-Value= 0.08 Not significant

Table-4 showing the Age wise data



Among 100 SAM Children 43% of them were in the age group less than 12 months, 34% of them were in the age group of 12 to 24 months, 4% of them where in the age group of 24 to 36 months and 19% of them were between 36 to 60 months. P value was calculated using Pearson-Chi-Square test which was not significant.

Among 100 of the SAM children, 52 were female and 48 were male. P value was estimated as 0.346 which was not statistically significant.

		wtgnkgdaygp1			
		Poor	**Moderate**	**Good**	**Total**
F	Count	7	27	18	52
	% within SEX	13.5%	51.9%	34.6%	100.0%
	% within wtgnkgdaygp1	38.9%	58.7%	50.0%	52.0%
M	Count	11	19	18	48
	% within SEX	22.9%	39.6%	37.5%	100.0%
	% within wtgnkgdaygp1	61.1%	41.3%	50.0%	48.0%
Total	Count	18	46	36	100
	% within SEX	18.0%	46.0%	36.0%	100.0%
	% within wtgnkgdaygp1	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square P Value =0.346 Not significant

Table 5 showing the sex wise data

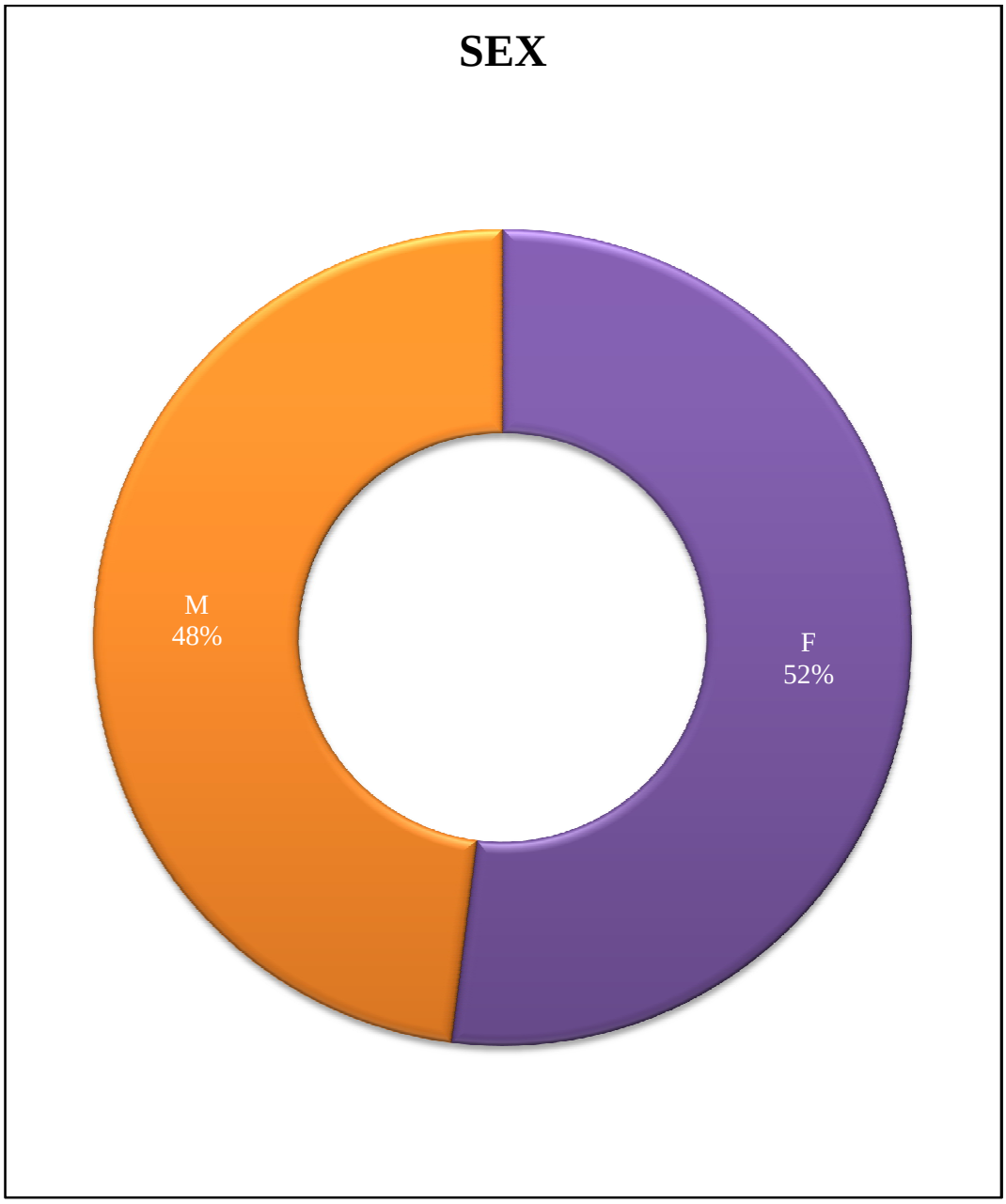


Chart Showing Sex wise Comparison

When appetite was assessed 73 of the 100 SAM children were found to have a normal appetite, 23 of them had poor appetite and 4 of them had no appetite. P value was calculated as 0.516 which was not statistically significant.

			wtgnkgdaygp1			Total
			Poor	Moderate	Good	
APETITE	NORMAL	Count	14	33	26	73
		% within APETITE	19.2%	45.2%	35.6%	100.0%
		% within wtgnkgdaygp1	77.8%	71.7%	72.2%	73.0%
	POOR	Count	4	12	7	23
		% within APETITE	17.4%	52.2%	30.4%	100.0%
		% within wtgnkgdaygp1	22.2%	26.1%	19.4%	23.0%
	NO APPETITE	Count	0	1	3	4
		% within APETITE	.0%	25.0%	75.0%	100.0%
		% within wtgnkgdaygp1	.0%	2.2%	8.3%	4.0%
Total		Count	18	46	36	100
		% within APETITE	18.0%	46.0%	36.0%	100.0%
		% within wtgnkgdaygp1	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square P- Value = 0.516 Not significant.

Table 6 showing the data on the appetite of the SAM children on admission

17 of the SAM children had vomiting at presentation and 83 of them did not have vomiting. P value was found to be 0.076 which was not statistically significant.

			wtgnkgdaygp1	Total		
			Poor	**Moderate**	**Good**	
VOMITING	**yes**	Count	1	6	10	17
		% within VOMITING	5.9%	35.3%	58.8%	100.0%
		% within wtgnkgdaygp1	5.6%	13.0%	27.8%	17.0%
	no	Count	17	40	26	83
		% within VOMITING	20.5%	48.2%	31.3%	100.0%
		% within wtgnkgdaygp1	94.4%	87.0%	72.2%	83.0%
Total		Count	18	46	36	100
		% within VOMITING	18.0%	46.0%	36.0%	100.0%
		% within wtgnkgdaygp1	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square P- Value = 0.076 Not significant

Table - 7 showing the children with and without vomiting at presentation

Among 100 of the SAM children, 23 of them had diarrhea on admission and 77 of them did not have diarrhea. P value was 0.414 which was not statistically significant.

			wtgnkgdaygp1			Total
			Poor	Moderate	Good	
DIARRHOEA	yes	Count	2	12	9	23
		% within DIARRHOEA	8.7%	52.2%	39.1%	100.0%
		% within wtgnkgdaygp1	11.1%	26.1%	25.0%	23.0%
	no	Count	16	34	27	77
		% within DIARRHOEA	20.8%	44.2%	35.1%	100.0%
		% within wtgnkgdaygp1	88.9%	73.9%	75.0%	77.0%
Total		Count	18	46	36	100
		% within DIARRHOEA	18.0%	46.0%	36.0%	100.0%
		% within wtgnkgdaygp1	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square P- Value = 0.414 Not significant

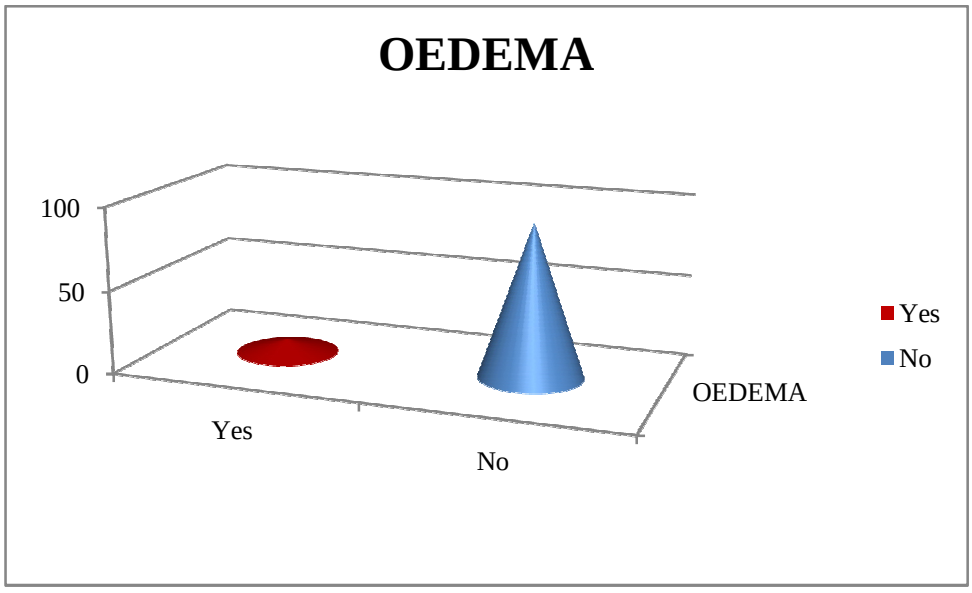
Table -8 showing children with and without vomiting at presentation

Only 8 among the 100 SAM children presented with edema whereas the rest 92 of them did not had edema on presentation. P value was found to be 0.202 which was not statistically significant.

			wtgnkgdaygp1			
	yes		Poor	Moderate	Good	Total
OEDEMA		Count	3	4	1	8
		% within OEDEMA	37.5%	50.0%	12.5%	100.0%
	no	% within wtgnkgdaygp1	16.7%	8.7%	2.8%	8.0%
		Count	15	42	35	92
		% within OEDEMA	16.3%	45.7%	38.0%	100.0%
		% within wtgnkgdaygp1	83.3%	91.3%	97.2%	92.0%
Total		Count	18	46	36	100
		% within OEDEMA	18.0%	46.0%	36.0%	100.0%
		% within wtgnkgdaygp1	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square P- Value = 0.202 Not significant

Table-9 showing the children with and without edema



Among 100 SAM children, 43 of them presented with fever and 57 of them did not have fever. P value was calculated for this data and it was found to be 0.563 which was not statistically significant.

			wtgnkgdaygp1			
			Poor	**Moderate**	**Good**	**Total**
FEVER	**yes**	Count	8	22	13	43
		% within FEVER	18.6%	51.2%	30.2%	100.0%
		% within wtgnkgdaygp1	44.4%	47.8%	36.1%	43.0%
	no	Count	10	24	23	57
		% within FEVER	17.5%	42.1%	40.4%	100.0%
		% within wtgnkgdaygp1	55.6%	52.2%	63.9%	57.0%
Total		Count	18	46	36	100
		% within FEVER	18.0%	46.0%	36.0%	100.0%
		% within wtgnkgdaygp1	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square P- Value = 0.563 Not significant

Table-10 Showing the SAM children with and without history of fever

15 of the 100 SAM children had breathlessness on presentation and 85 of them did not have breathlessness. P value was found to be 0.36 which was not statistically significant.

			wtgnkgdaygp1			
			Poor	**Moderate**	**Good**	**Total**
DYSPNEA	**yes**	Count	3	9	3	15
		% within DYSPNEA	20.0%	60.0%	20.0%	100.0%
		% within wtgnkgdaygp1	16.7%	19.6%	8.3%	15.0%
	no	Count	15	37	33	85
		% within DYSPNEA	17.6%	43.5%	38.8%	100.0%
		% within wtgnkgdaygp1	83.3%	80.4%	91.7%	85.0%
Total		Count	18	46	36	100
		% within DYSPNEA	18.0%	46.0%	36.0%	100.0%
		% within wtgnkgdaygp1	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square P- Value = 0.360 Not significant

Table-11 showing SAM children with and without dyspnea on presentation

70% of the children had history of weight loss whereas the rest 30% of them did not have any history of weight loss. P value was calculated and was found to be 0.615 which was not statistically significant.

			wtgnkgdaygp1			
			Poor	**Moderate**	**Good**	**Total**
Wt loss	**yes**	Count	13	30	27	70
		% within wt loss	18.6%	42.9%	38.6%	100.0%
		% within wtgnkgdaygp1	72.2%	65.2%	75.0%	70.0%
	no	Count	5	16	9	30
		% within wt loss	16.7%	53.3%	30.0%	100.0%
		% within wtgnkgdaygp1	27.8%	34.8%	25.0%	30.0%
Total		Count	18	46	36	100
		% within wt loss	18.0%	46.0%	36.0%	100.0%
		% within wtgnkgdaygp1	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square P- Value = 0.615 Not significant

Table-12 showing children with and without history of weight loss

95 of the 100 children were below -3 SD whereas only 5 of them were between -2 SD to -3SD. P value was found to be 0.963 which was statistically not significant.

WHZ			wtgnkgdaygp1			
			Poor	**Moderate**	**Good**	**Total**
	-3	Count	17	44	34	95
		% within WHZ	17.9%	46.3%	35.8%	100.0%
		% within wtgnkgdaygp1	94.4%	95.7%	94.4%	95.0%
	-2 to -3	Count	1	2	2	5
		% within WHZ	20.0%	40.0%	40.0%	100.0%
		% within wtgnkgdaygp1	5.6%	4.3%	5.6%	5.0%
Total		Count	18	46	36	100
		% within WHZ	18.0%	46.0%	36.0%	100.0%
		% within wtgnkgdaygp1	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square P- Value = 0.963 Not significant

Table-13 showing the data according to the WHO z score

96 of the 100 SAM children had Pallor whereas only 4 of them did not have pallor. P value was calculated and it was found to be 0.438 which was statistically not significant.

			wtgnkgdaygp1			Total
			Poor	**Moderate**	**Good**	
PALLOR	**yes**	Count	18	43	35	96
		% within PALLOR	18.8%	44.8%	36.5%	100.0%
		% within wtgnkgdaygp1	100.0%	93.5%	97.2%	96.0%
	no	Count	0	3	1	4
		% within PALLOR	.0%	75.0%	25.0%	100.0%
		% within wtgnkgdaygp1	.0%	6.5%	2.8%	4.0%
Total		Count	18	46	36	100
		% within PALLOR	18.0%	46.0%	36.0%	100.0%
		% within wtgnkgdaygp1	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square P- Value = 0.438 Not significant

Table-14 showing the children with and without pallor

Among 100 SAM children 10 of them had pedal edema while the rest 90 did not have. P value was calculated to be 0.581 which was not statistically significant.

			wtgnkgdaygp1			
			Poor	**Moderate**	**Good**	**Total**
P_EDEMA	**Yes**	Count	3	4	3	10
		% within P_EDEMA	30.0%	40.0%	30.0%	100.0%
		% within wtgnkgdaygp1	16.7%	8.7%	8.3%	10.0%
	No	Count	15	42	33	90
		% within P_EDEMA	16.7%	46.7%	36.7%	100.0%
		% within wtgnkgdaygp1	83.3%	91.3%	91.7%	90.0%
Total		Count	18	46	36	100
		% within P_EDEMA	18.0%	46.0%	36.0%	100.0%
		% within wtgnkgdaygp1	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square P- Value = 0.581 Not significant

Table 15 showing the children with and without pedal edema on examination

84 of the 100 SAM children had hair changes at presentation whereas the rest 16 of them did not have. P value was found to be 0.819 which was not statistically significant.

			wtgnkgdaygp1			Total
			Poor	Moderate	Good	
HAIR Changes	yes	Count	16	38	30	84
		% within HAIR_CHN	19.0%	45.2%	35.7%	100.0%
		% within wtgnkgdaygp1	88.9%	82.6%	83.3%	84.0%
	no	Count	2	8	6	16
		% within HAIR_CHN	12.5%	50.0%	37.5%	100.0%
		% within wtgnkgdaygp1	11.1%	17.4%	16.7%	16.0%
Total		Count	18	46	36	100
		% within HAIR_CHN	18.0%	46.0%	36.0%	100.0%
		% within wtgnkgdaygp1	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square P- Value = 0.819 Not significant

Table-16 showing the children with and without hair changes

Among 100 SAM children only 14 of them had skin changes while the rest 86 of them did not have any skin changes. P value was calculated which was found to be 0.356 which is statistically insignificant.

			wtgnkgdaygp1			
			Poor	**Moderate**	**Good**	**Total**
SKIN Changes	**yes**	Count	3	4	7	14
		% within SKIN_CHN	21.4%	28.6%	50.0%	100.0%
		% within wtgnkgdaygp1	16.7%	8.7%	19.4%	14.0%
	no	Count	15	42	29	86
		% within SKIN_CHN	17.4%	48.8%	33.7%	100.0%
		% within wtgnkgdaygp1	83.3%	91.3%	80.6%	86.0%
Total		Count	18	46	36	100
		% within SKIN_CHN	18.0%	46.0%	36.0%	100.0%
		% within wtgnkgdaygp1	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square P- Value = 0.356 Not significant

Table-17 showing the children with and without skin changes

Among the 100 SAM children, only 3 of them had bitot's spot, whereas the rest 97 of them did not had any bitot's spot. P value was calculated which was found to be 0.163 which was statistically not significant.

			wtgnkgdaygp1			Total
			Poor	Moderate	Good	
BITTOTSPOT	yes	Count	0	3	0	3
		% within BITTOTSPOT	.0%	100.0%	.0%	100.0%
		% within wtgnkgdaygp1	.0%	6.5%	.0%	3.0%
	no	Count	18	43	36	97
		% within BITTOTSPOT	18.6%	44.3%	37.1%	100.0%
		% within wtgnkgdaygp1	100.0%	93.5%	100.0%	97.0%
Total		Count	18	46	36	100
		% within BITTOTSPOT	18.0%	46.0%	36.0%	100.0%
		% within wtgnkgdaygp1	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square P- Value = 0.163 Not significant

Table-18 showing the children with and without Bitot's spot

9 of the 100 SAM children had glossitis whereas the rest 91 of them did not have glossitis. P value was calculated using Pearson Chi Square test and it was 0.05 which was statistically significant, hence implying that glossitis has a strong association with SAM.

			wtgnkgdaygp1			
			Poor	**Moderate**	**Good**	**Total**
GLOSSITIS	**yes**	Count	2	7	0	9
		% within GLOSSITIS	22.2%	77.8%	.0%	100.0%
		% within wtgnkgdaygp1	11.1%	15.2%	.0%	9.0%
	no	Count	16	39	36	91
		% within GLOSSITIS	17.6%	42.9%	39.6%	100.0%
		% within wtgnkgdaygp1	88.9%	84.8%	100.0%	91.0%
Total		Count	18	46	36	100
		% within GLOSSITIS	18.0%	46.0%	36.0%	100.0%
		% within wtgnkgdaygp1	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square P- Value = 0.05 significant

Table-19 showing the children with and without glossitis

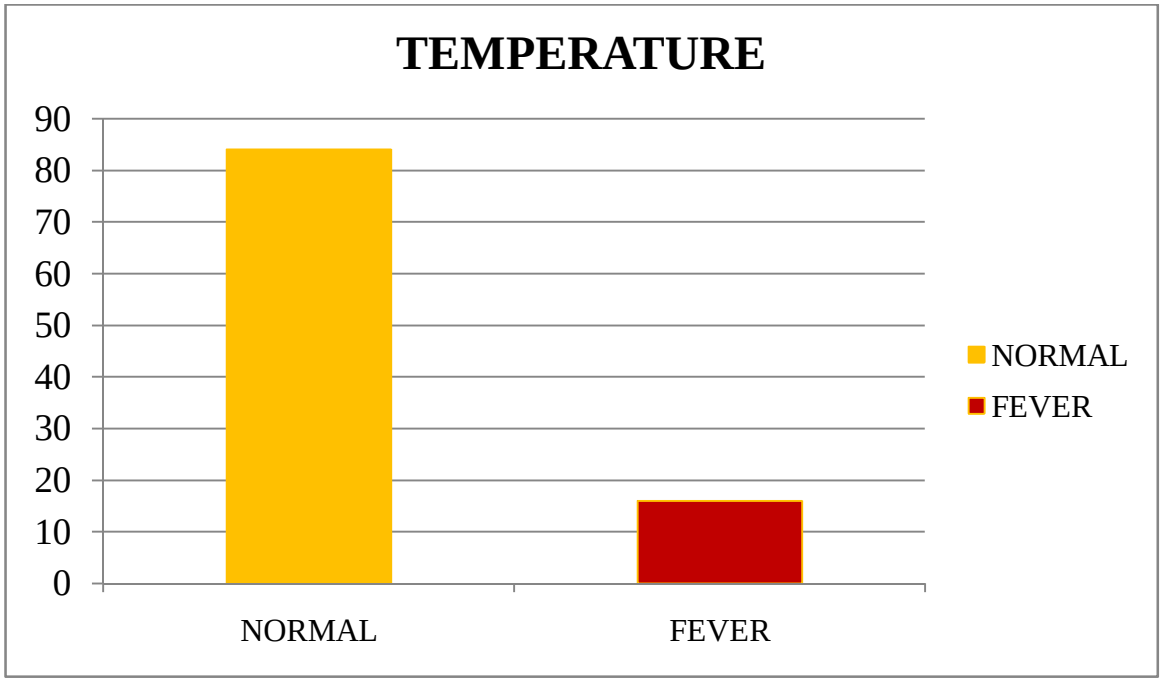


Chart showing SAM Children with Fever and Normal Temperature

84 of the 100 children had normal temperature and only the rest 16 were found to have fever. P value was calculated which was found to be 0.000 which was highly significant. Therefore in this study it was found that SAM children instead of presenting with fever can have a normal temperature indicating that we should not neglect the possibility of infection even in the absence of fever.

			wtgnkgdaygp1			Total
			Poor	Moderate	Good	
TEMP	NORMAL	Count	10	44	30	84
		% within TEMP	11.9%	52.4%	35.7%	100.0%
		% within wtgnkgdaygp1	55.6%	95.7%	83.3%	84.0%
	FEVER	Count	8	2	6	16
		% within TEMP	50.0%	12.5%	37.5%	100.0%
		% within wtgnkgdaygp1	44.4%	4.3%	16.7%	16.0%
Total		Count	18	46	36	100
		% within TEMP	18.0%	46.0%	36.0%	100.0%
		% within wtgnkgdaygp1	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square P- Value = 0.000 Significant

Table-20 showing the children with and without fever on Examination

1% of the total children were exclusively breast fed till 2months, 11% till 3, 8% till 4 months, 22% till 5 months, 41% till 6 months, 14 till 7 and 3% of them till 8 months of age.

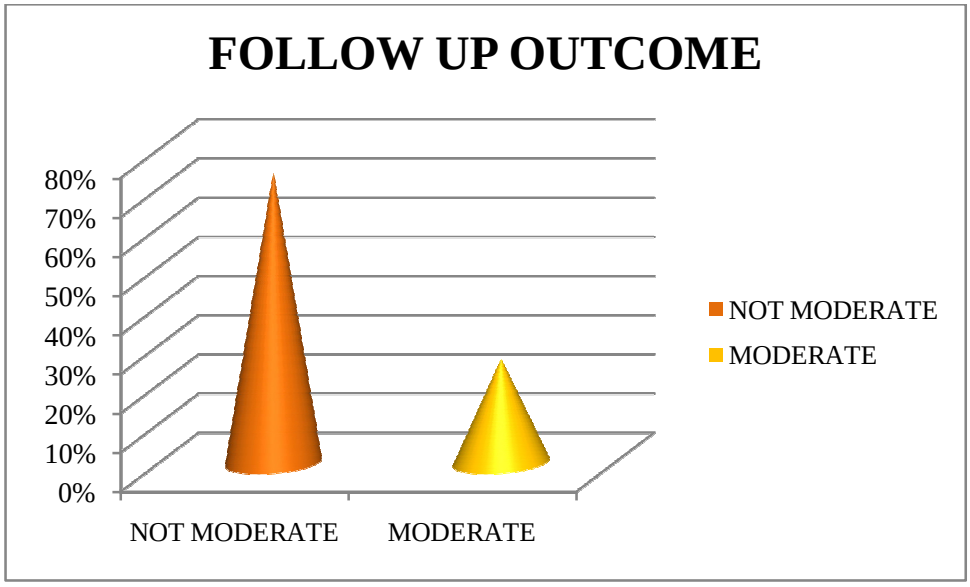
EBF month		Frequency	Percent
	2	1	1.0
	3	11	11.0
	4	8	8.0
	5	22	22.0
	6	41	41.0
	7	14	14.0
	8	3	3.0
	Total	**100**	**100.0**

Table- 23 shows the distribution of children based on the Months of breast feeding

	wtgnkgdaygp	N	Mean	Std. Deviation	P-Value
EBF_mon	No_Mod Imp	18	5.56	1.042	
	Moderate imp	82	5.43	1.343	.704
WEANING	No_Mod Imp	18	5.56	1.042	.704
	Moderate imp	82	5.43	1.343	
MUAC	No_Mod Imp	18	11.66	.459	
	Moderate imp	82	11.40	.973	.274
Hb	No_Mod Imp	18	8.84	2.244	
	Moderate imp	82	9.43	1.626	.200
B_SUGAR	No_Mod Imp	18	78.61	15.271	.843
	Moderate imp	82	77.74	17.048	
DUR_STAY	No_Mod Imp	18	7.06	2.287	
	Moderate imp	82	7.12	2.395	.915
WOA	No_Mod Imp	18	7.4328	2.10775	.196
	Moderate imp	82	6.8539	1.61348	
WOD	No_Mod Imp	18	7.5822	2.20239	
	Moderate imp	82	7.3272	1.61798	.573
wtgndis	No_Mod Imp	18	.1494	.11684	
	Moderate imp	82	.4733	.24782	.000

Table- 21 shows the mean, standard deviation and P value of various variables, among which P value of the weight gain attained at the time of the discharge is 0.000 which is highly significant and implies that the weight gain achieved was significant

Among the 100 SAM children discharged, 10 of them did not come for follow up at the end of 1 st week. 4 lost follow up at 2nd week and another 4 of them did not come for follow up at the end of 4th week. 80% of the children completed the 4 week follow up. The mean weight gain obtained was 4.5 gm/kg/day. Among the 80 children 73.7% had a weight gain of <5gm/kg/day and 26.3% of them had a weight gain of >5 gm/kg/day.



NOT MODERATE	59	73.7%
MODERATE	21	26.3%
Total	80	100%

Table -22 showing outcome in the SAM children who were followed up for 1 month

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
EBF_mon	Equal variances assumed	.906	.344	.382	98	.704	.129	.337	-.541	.798
	Equal variances not assumed			.449	30.806	.657	.129	.287	-.456	.714
WEANING	Equal variances assumed	.906	.344	.382	98	.704	.129	.337	-.541	.798
	Equal variances not assumed			.449	30.806	.657	.129	.287	-.456	.714
MUAC	Equal variances assumed	3.676	.058	1.100	98	.274	.259	.236	-.208	.727
	Equal variances not assumed			1.699	55.705	.095	.259	.153	-.046	.565
Hb	Equal variances assumed	1.270	.263	-1.291	98	.200	-.588	.455	-1.492	.316
	Equal variances not assumed			-1.053	21.088	.304	-.588	.559	-1.749	.573
B_SUGAR	Equal variances assumed	.042	.838	.199	98	.843	.867	4.361	-7.786	9.521
	Equal variances not assumed			.213	27.148	.833	.867	4.062	-7.465	9.200
DUR_STAY	Equal variances assumed	.621	.433	-.107	98	.915	-.066	.619	-1.294	1.161
	Equal variances not assumed			-.111	25.856	.913	-.066	.601	-1.301	1.168
WOA	Equal variances assumed	1.830	.179	1.301	98	.196	.57888	.44496	-.30414	1.46189
	Equal variances not assumed			1.097	21.580	.285	.57888	.52779	-.51692	1.67467
WOD	Equal variances assumed	2.453	.121	.565	98	.573	.25503	.45122	-.64041	1.15046
	Equal variances not assumed			.465	21.204	.647	.25503	.54900	-.88601	1.39606
wtgndis	Equal variances assumed	6.155	.015	-5.398	98	.000	-.32385	.06000	-.44291	-.20479
	Equal variances not assumed			-8.341	55.741	.000	-.32385	.03883	-.40163	-.24606

Correlations									
		WOA	WOD	wtgnw2	wtgnw3	wtgnw4	wtgnw5	wtgnw6	wtgnw7
WOA	Pearson Correlation	1	.989**	.137	.159	.141	.153	.109	-.035
	Sig. (2-tailed)		.000	.175	.115	.164	.132	.319	.825
	N	100	100	100	100	99	98	86	43
WOD	Pearson Correlation	.989**	1	.145	.175	.153	.184	.126	.037
	Sig. (2-tailed)	.000		.149	.081	.130	.070	.246	.813
	N	100	100	100	100	99	98	86	43
wtgnw2	Pearson Correlation	.137	.145	1	.372**	.130	-.041	.103	-.093
	Sig. (2-tailed)	.175	.149		.000	.198	.692	.343	.554
	N	100	100	100	100	99	98	86	43
wtgnw3	Pearson Correlation	.159	.175	.372**	1	.807**	.083	-.108	.461**
	Sig. (2-tailed)	.115	.081	.000		.000	.419	.323	.002
	N	100	100	100	100	99	98	86	43
wtgnw4	Pearson Correlation	.141	.153	.130	.807**	1	.155	-.004	.809**
	Sig. (2-tailed)	.164	.130	.198	.000		.128	.974	.000
	N	99	99	99	99	99	98	86	43
wtgnw5	Pearson Correlation	.153	.184	-.041	.083	.155	1	.040	.915**
	Sig. (2-tailed)	.132	.070	.692	.419	.128		.713	.000
	N	98	98	98	98	98	98	86	43
wtgnw6	Pearson Correlation	.109	.126	.103	-.108	-.004	.040	1	.971**
	Sig. (2-tailed)	.319	.246	.343	.323	.974	.713		.000
	N	86	86	86	86	86	86	86	43
wtgnw7	Pearson Correlation	-.035	.037	-.093	.461**	.809**	.915**	.971**	1
	Sig. (2-tailed)	.825	.813	.554	.002	.000	.000	.000	
	N	43	43	43	43	43	43	43	43
**. Correlation is significant at the 0.01 level (2-tailed).									

		WOA	WOD	wtgnw8	wtgnw9	wtgnw10	wtgnw11	wtgnw12	wtgnw13	wtgnw14	wtgndis
WOA	Pearson Correlation	1	.989**	-.292	-.437	-.353	-.373	-.466	-.948**	.[a]	-.030
	Sig. (2-tailed)		.000	.199	.103	.216	.232	.149	.001	.	.770
	N	100	100	21	15	14	12	11	7	2	100
WOD	Pearson Correlation	.989**	1	-.161	-.244	-.150	-.137	-.241	-.886**	.[a]	.122
	Sig. (2-tailed)	.000		.485	.382	.608	.671	.475	.008	.	.227
	N	100	100	21	15	14	12	11	7	2	100
wtgnw8	Pearson Correlation	-.292	-.161	1	.994**	.973**	.957**	.982**	.984**	.[a]	.686**
	Sig. (2-tailed)	.199	.485		.000	.000	.000	.000	.000	.	.001
	N	21	21	21	15	14	12	11	7	2	21
wtgnw9	Pearson Correlation	-.437	-.244	.994**	1	.974**	.969**	.989**	.992**	.[a]	.895**
	Sig. (2-tailed)	.103	.382	.000		.000	.000	.000	.000	.	.000
	N	15	15	15	15	14	12	11	7	2	15
wtgnw10	Pearson Correlation	-.353	-.150	.973**	.974**	1	.993**	.979**	.998**	.[a]	.926**
	Sig. (2-tailed)	.216	.608	.000	.000		.000	.000	.000	.	.000
	N	14	14	14	14	14	12	11	7	2	14
wtgnw11	Pearson Correlation	-.373	-.137	.957**	.969**	.993**	1	.976**	.991**	.[a]	.981**
	Sig. (2-tailed)	.232	.671	.000	.000	.000		.000	.000	.	.000
	N	12	12	12	12	12	12	11	7	2	12
wtgnw12	Pearson Correlation	-.466	-.241	.982**	.989**	.979**	.976**	1	.992**	.[a]	.957**
	Sig. (2-tailed)	.149	.475	.000	.000	.000	.000		.000	.	.000
	N	11	11	11	11	11	11	11	7	2	11
wtgnw13	Pearson Correlation	-.948**	-.886**	.984**	.992**	.998**	.991**	.992**	1	.[a]	.990**
	Sig. (2-tailed)	.001	.008	.000	.000	.000	.000	.000		.	.000
	N	7	7	7	7	7	7	7	7	2	7
wtgnw14	Pearson Correlation	.[a]	.[a]	.[a]	.[a]	.[a]	.[a]	.[a]	.[a]	.[a]	.[a]
	Sig. (2-tailed)	.	.	.	.	.	.	.	.		.
	N	2	2	2	2	2	2	2	2	2	2
wtgndis	Pearson Correlation	-.030	.122	.686**	.895**	.926**	.981**	.957**	.990**	.[a]	1
	Sig. (2-tailed)	.770	.227	.001	.000	.000	.000	.000	.000	.	
	N	100	100	21	15	14	12	11	7	2	100
**. Correlation is significant at the 0.01 level (2-tailed).											

Initial wtvs Each day wt	Correlation Value	Sample(n)	P-Value	Result
Wt at Day1				
Wt at Day2	0.137	100	0.175	Not Significant
Wt at Day3	0.159	100	0.115	NS
Wt at Day4	0.141	99	0.164	NS
Wt at Day5	0.153	98	0.132	NS
Wt at Day6	0.109	86	0.319	NS
Wt at Day7	-0.035	43	0.825	NS
Wt at Day8	-0.292	21	0.199	
Wt at Day9	-0.437	15	0.103	
Wt at Day10	-0.353	14	0.216	
Wt at Day11	-0.373	12	0.232	
Wt at Day12	-0.466	11	0.149	
Wt at Day13	-0.948	7	0.001	
Wt at Day14		2		
Wt at Day15				
WOD	0.989	100	0.000	Significant

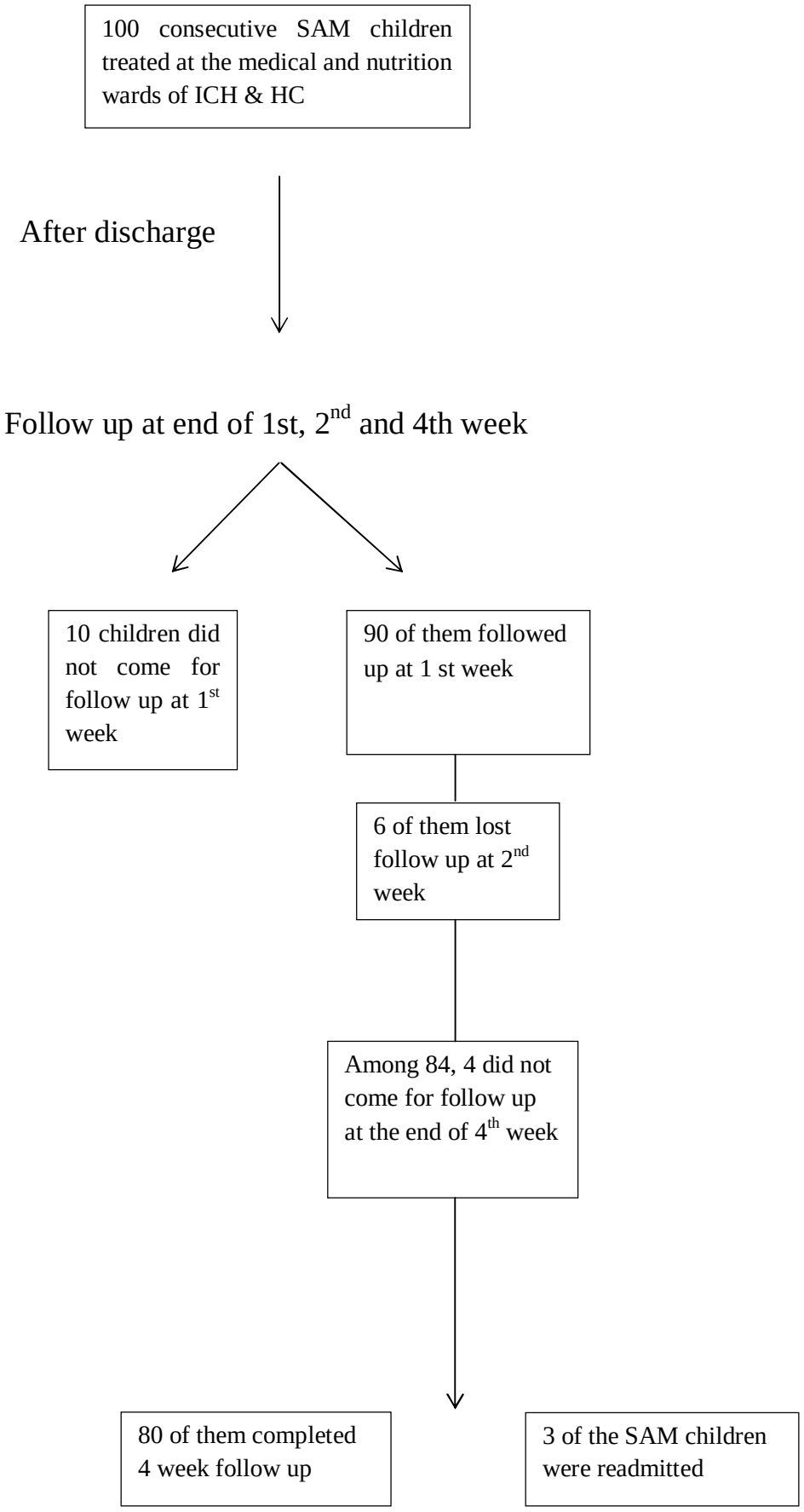
Table-22 shows the weight gain achieved on each day and the P value also has been calculated. The P value for the weight on discharge as compared to the initial weight was 0.000 which was statistically significant.

SUMMARY

1. Among the 100 children, 18% were found to have a poor outcome (<5gm/kg/day), 46% of them were found to have a moderate outcome (between 5 to 10gm/kg/day) and 36 % were found to have a good outcome (>10gm/kg/day).
2. The mean weight gain in this study was found to be 8.5gm/kg/day.
3. The mean weight gain was found to be 2.8gm/kg/day in the children with poor outcome, 7.4gm/kg/day in those with moderate outcome and a mean weight gain of 12gm/kg/day in those with good outcome.
4. Out of the 100 SAM children, 18 of them were admitted for diarrhea, 12 of them had pneumonia, another 9 of them were admitted for malnutrition (reduced weight gain), 5 of them had diarrhea and malnutrition, 2 of them had diarrhea and pneumonia, 1 child had diarrhea, pneumonia and malnutrition as the cause for admission and rest 53 of them were admitted with other complaints such as acute CNS infection, viral fever, typhoid etc.
5. No sex predilection was noted
6. Most of them belonged to the age group of 12 to 24 months.
7. 73 of the 100 SAM children were found to have a normal appetite, 23 of them had poor appetite and 4 of them had no appetite.

8. Vomiting was a common symptom in only 17 % of the children.
9. 23 of the 100 children had diarrhea on admission.
10. Only 15 of the 100 children had breathlessness.
11. 95 of the children were below -3SD. Only 5 of them were between -2 to -3 SD.
12. Among 100 children 96 of them had anemia.
13. Only 10 of the 100 children had Pedal edema on examination.
14. 84 of the 100 SAM children had hair changes at presentation whereas the rest 16 of them did not have any.
15. Among 100 SAM children only 14 of them had skin changes.
16. Among the 100 SAM children, only 3 of them had bitot's spot, whereas the rest 97 of them did not had any bitot's spot.
17. 9 of the 100 SAM children had glossitis whereas the rest 91 of them did not have glossitis. P value was calculated using Pearson Chi Square test and it was 0.05 which was statistically significant, hence implying that glossitis has a strong association with SAM.
18. 84 of the 100 children had normal temperature and only the rest 16 were found to have fever. P value was calculated which was found to be 0.000 which was highly significant. Therefore in this study it was found that SAM children instead of presenting with fever can have a normal temperature indicating that we should not neglect the possibility of infection even in the absence of fever.

19. Average MUAC was found to be 11.66 in the group with no improvement (weight gain < 5gm/kg/day) and 11.4 in those with moderate improvement (weight gain > 5 gm/kg/day)
20. Average duration of stay in the group with no improvement was found to be 7.06 days and those in moderate improvement group was 7.12 days. 43 of the 100 SAM children stayed up to 7 days and only 2 of them were admitted in ward up to 14 days.
21. Weight gain on discharge in the no improvement group was 0.1494 and in the moderate improvement group was 0.4733 and the P value was found to be 0.000 which was clinically significant.
22. 1% of the total children were exclusively breast fed till 2months, 11% till 3, 8% till 4 months, 22% till 5 months, 41% till 6 months, 14 till 7 and 3% of them till 8 months of age.
23. Among the 100 SAM children discharged, 10 of them did not come for follow up at the end of 1 st week. 6 lost follow up at 2^{nd} week and another 4 of them did not come for follow up at the end of 4^{th} week.
24. 80% of the children completed the 4 week follow up. The mean weight gain obtained was 4.5 gm/kg/day. Among the 80 children 73.7% had a weight gain of <5gm/kg/day and 26.3% of them had a weight gain of >5 gm/kg/day.


100 consecutive SAM children treated at the medical and nutrition wards of ICH & HC
After discharge
Follow up at end of 1st, 2nd and 4th week
10 children did not come for follow up at 1st week
90 of them followed up at 1 st week
6 of them lost follow up at 2nd week
Among 84, 4 did not come for follow up at the end of 4th week
80 of them completed 4 week follow up
3 of the SAM children were readmitted

DISCUSSION

Severe acute malnutrition increases the risk of death in children under the age of 5 years. Therefore its identification and management plays a vital role in the reduction in the under-five mortality rates.

Management of SAM children consists of an initial stabilization phase followed by a rehabilitation phase during which rapid catch up growth in weight (>10g/kg/day) needs to be achieved as it facilitates early discharge and prevents secondary infections.

The present study was done to assess the efficacy of the feeding guidelines given by WHO and also to find out the feasibility of implementation of these guidelines in our hospital setting. It also studies the weight gain achieved in severely malnourished children receiving feeds as per WHO guidelines at a tertiary hospital.

Out of the 100 SAM children participated in our study 18% were found to have a poor outcome (<5gm/kg/day), 46% of them were found to have a moderate outcome (between 5 to 10gm/kg/day) and 36 % were found to have a good outcome (>10gm/kg/day) that was similar to the results obtained in a study conducted by Md Iqbal Hossain et al.

In their study 14.7% of the children demonstrated poor gain in weight, 30.9% moderate, and the remaining 30.9% demonstrated good gain in weight.

The average duration of stay in the hospital was 7 days which was much less than duration of hospital stay in the studies conducted by Raja Sriswan Mamidi et al (5 weeks).

Only 1% of the children had loss of weight compared to the initial weight which was far above than seen in the study by Md Iqbal Hosssain wherein there was loss of weight in 19.8%, no change in weight in 3.7%, and weight gain in 76.5% of the treated children.

The mean weight gain in our study was 8.5gm/kg/day which was more than the Deepak et al (3.2gm/kg/day), Ashraf, *et al.* (*23*) (6 g/kg/d), and Khanum, *et al* (4 g/kg/d) (24) and less than the Gaboulaud, *et al.* (22) (9.7 g/kg/day).Rapid catch up growth of >10g/kg/day in hospital-based rehabilitation was seen in centers from Jamaica and Bangladesh (25).

In this study 43% of the SAM children were found to be less than 12months of age, 34% of them belonged to the age group between 12 to 24 months. 4% of them were in the age group of 24 to

36months and 19% of them between 36 to 60 months which was comparable to the previous studies.

Even though the average duration of stay was 7 days which was far less than seen in other studies, the weight gain achieved at the time of discharge was statistically significant.

Also the mean weight gain achieved in our study (8.5gm/kg/day) was comparable to the weight gain achieved in other studies conducted in other parts of the world.

During the follow up the weight gain achieved by the SAM children were moderate (mean weight gain of 4.5 gm/kg/day) which was comparable to the study conducted by Deepak et al which showed a weight gain of 3.2gm/kg/day in home based management of SAM children.

Following are the limitations of the present study:

1. Relatively smaller sample size.
2. Average duration of stay was 7 days which was less compared to other studies and hence even though the mean weight gain was good, the children were unable to achieve W/H score of -1 SD due to shorter duration of hospital stay.
3. Mothers were involved in the care of the children including the preparation of feeds. Hence uniformity could not be maintained.

CONCLUSION

This study was conducted in the department of Pediatrics, Madras Medical College from November 2010 to October 2012. A total of 100 SAM children were included in the study and were given feeds as per the WHO guidelines and the outcome were assessed in terms of weight gain achieved at the time of discharge.

Majority of the children achieved good weight gain and the mean weight gain was found to be 8.5gm/kg/day which was comparable to those achieved in other studies.

The reason for not achieving a weight gain of > 10 gm/kg/day as given by WHO in most of the children were due to the short duration of stay in the hospital and absence of uniformity in the preparation of feeds for the children as it was done by their mothers.

During a 1 month follow up, it was found that weight gain achieved by the SAM children was moderate (mean weight gain was 4.5gm/kg/day). This could be due to the absence of availability of a RUTF to the SAM children during the home based rehabilitation.

Thus from the present study it could be concluded that feeding guidelines given by WHO are effective and can be successfully

implemented in our hospital setting with slight modifications. And also even though the weight gain achieved in our study was moderate, it was significant and could be improved if various limitations could be overcome.

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INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI -3

Telephone No : 044 25305301
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CERTIFICATE OF APPROVAL

To
Dr. Shruthi Purushotham
PG in MD Paediatrics
Madras Medical College, Chennai -3

Dear Dr. Shruthi Purushotham

The Institutional Ethics committee of Madras Medical College, reviewed and discussed your application for approval of the proposal entitled " Hospital based management of severe Acute malnutrition children at a tertiary hospital" No.1912012.

The following members of Ethics Committee were present in the meeting held on 27.01.2012 conducted at Madras Medical College, Chennai -3.

1. Prof. S.K. Rajan. MD -- Chairperson
2. Prof. Pregna B. Dolia MD -- Member Secretary
   Vice Principal, Madras Medical College, Chennai -3
   (Director , Institute of Biochemistry, MMC, Ch-3)
3. Prof. B. Kalaiselvi. MD -- Member
   Prof of Pharmacology ,MMC, Ch-3
4. Prof. Shruti Kamal MS -- Member
   Prof of Surgery, Madras Medical College , Ch-3
5. Thiru. S. Govindsamy. BA BL -- Lawyer

We approve the proposal to be conducted in its presented form.

Sd/ Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, and SAE occurring in the course of the study, any changes in the protocol and patients information / informed consent and asks to be provided a copy of the final report.

Member Secretary, Ethics Committee

Proforma

NAME: AGE/SEX: IP NO:
WARD:

FATHER'S NAME:

MOTHER'S NAME:

ADDRESS:

DOA: DOD:

FAMILY INFORMATION:

FATHER'S AGE: OCCUPATION:
EDUCATION:

MOTHER'S AGE: OCCUPATION:
EDUCATION:

MONTHLY INCOME:

HOUSING: SANITATION:
DRINKING WATER:

FAMILY HISTORY: MEDICAL HISTORY:

COMPLAINTS:

APPETITE: HUNGRY / NORMAL / POOR / NO APPETITE

VOMITING: YES / NO

DIARRHOEA: YES / NO

OEDEMA:

SHORTNESS OF BREATH: YES / NO

COUGH: YES / NO

FEVER: YES/NO

SKIN CHANGES: YES/NO

HAIR CHANGES: YES/NO

WEIGHT LOSS: YES/NO

H/O MEASLES IN THE RECENT PAST:

DIETARY HISTORY:

DURATION OF EXCLUSIVE BREASTFEEDING:

TOTAL DURATION/AGE AT WHICH BREAST FEEDING STOPPED:

AGE OF WEANING:

USUAL DIET BEFORE ILLNESS☹24 HR RECALL METHOD):

DIET DURING PAST 24HRS:

IMMUNISATION HISTORY:

EXAMINATION:

HEIGHT: WEIGHT: Wt/Ht (SD): MUAC:

HC: TEMP:

PALLOR/ICTERUS/CYANOSIS/CLUBBING/LYMPHADENOPATHY/PEDAL EDEMA

HR: RR: HYDRATION STATUS:

HEAD TO FOOT EXAMINATION:

a) HAIR CHANGES:

1) Hypo pigmented

2) Flag sign

3) Lustreless

b) SKIN CHANGES:

1) Hypo/ hyper pigmentation

2) Ulceration

3) Dermatoses

4) Exudative lesions

SIGNS OF VITAMIN DEFECIENCY-

a) VITAMIN A: DRY CONJUCTIVA/CORNEA/BITOTS SPOTS/CORNEAL ULCERATION/KERATOMALACIA

b) ORAL ULCERS, GLOSSITIS

c) BONY DEFORMITIES

SYSTEMIC EXAMINATION:

CVS:

RS:

P/A:

CNS:

INVESTIGATIONS:

Hb: TC: DC: P/S: BLOOD SUGAR:

SERUM ELECTROLYTES: SERUM PROTEINS:

RFT: LFT: CHEST XRAY:

HIV ELISA: MANTOUX: URINE ROUTINE:

URINE C/S: BLOOD CULTURE: STOOL M/E:

TREATMENTGIVEN:

24-Hour Food Intake Chart

Ward

Name

Hospital number

Age

Weight

Date of Admission

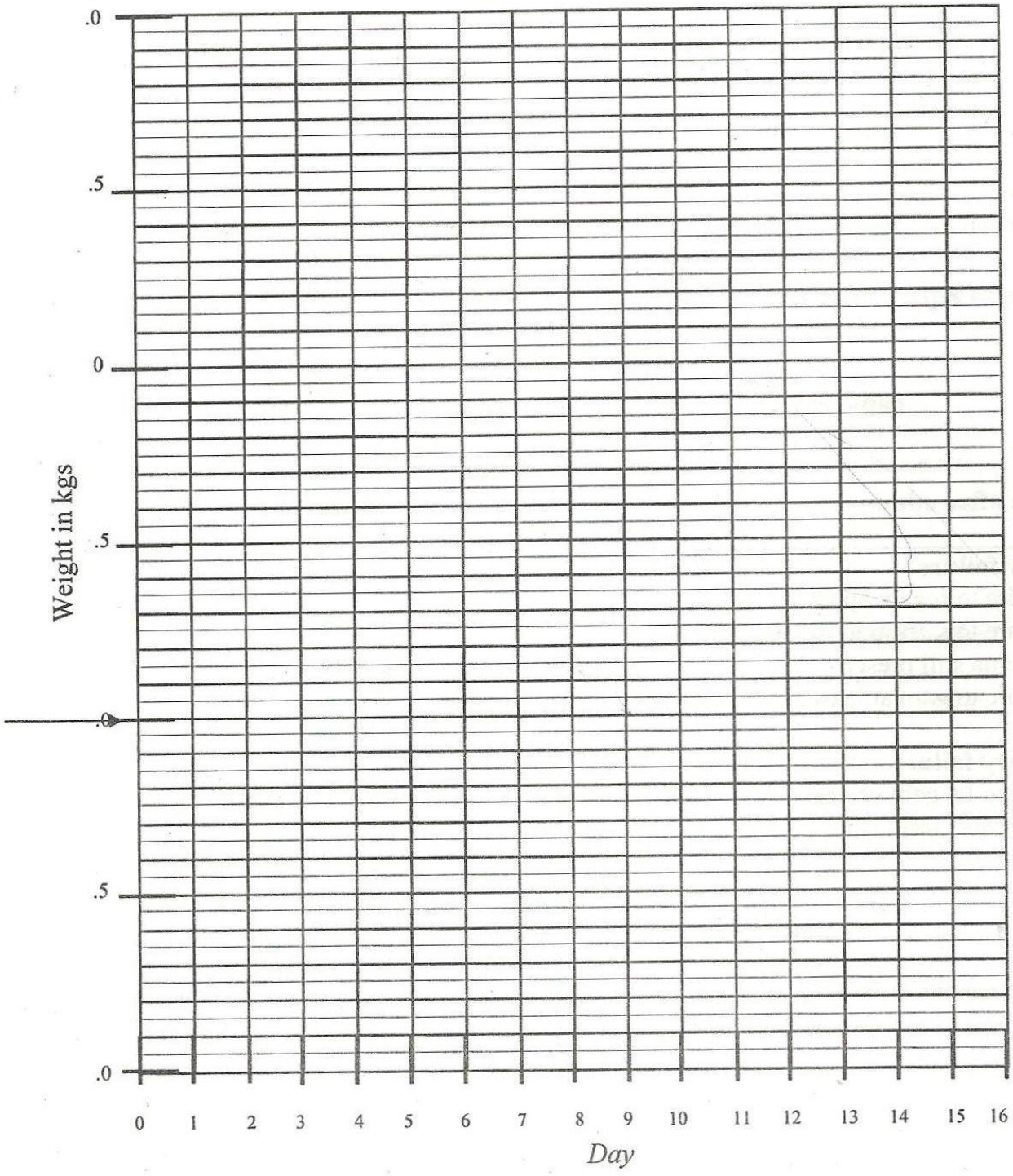
Date ..... Feed: ..... feeds of ..... ml each = ... ml per day

Time	Type of feed	Volume offered (ml)	Volume left in cup (ml)	Amount taken by child (ml)	Vomit estimate (ml)	Watery diarrhoea (Yes/No)
Totals:				Sub-total		Total taken in 24 hrs

Blank Weight Chart

Name: _____ Weight on admission_____

Age: _____ Weight on discharge_____



ABBREVIATIONS

1. SAM –Severe Acute Malnutrition.
2. WHZ- Weight for Height Z score.
3. NFHS- National Family Health Survey.
4. FIMNCI- Facility based integrated management of neonatal and childhood illness.
5. WHO - World Health Organisation.
6. SD - Standard Deviation.
7. WFH- Weight For height.
8. HFA- Height for Age.
9. WFA- Weight for age.
10. NG- Nasogastric.
11. ART- Anti Retroviral therapy.
12. ATT- Anti Tubercular treatment.
13. MUAC- Mid Upper Arm Circumference.
14. RUTF- Ready to use therapeutic food.
15. RTUF- Ready to use food.

MASTER CHART

NAME	DIAGNOSIS	AGE	SEX	APETITE	VOMITING	DIARRHOEA	MEDMA	FEVER	DYSPNEA	WTLOSS	EBF	DURBF	WEANING	HEIGHT (cm)	WEIGHT (kg)	WT/HT	MUAC (cm)	TEMP	PALLOR	PEDEMA	HAIRCHN	SKINCHN	BITOTS SPOT	CORNEAL ULCERS	ORAL ULCERS	GLOSSITIS	Hb	BSUGAR	DURATION OF STAY	W OA	W OD	W I	W2	W3	W4	W5	W6	W7	W 8	W 9	W 10	W 11	W 12	W 13	W 14	W 15
JAYASHREE	3	1Y 5M	F	2	2	2	2	2	2	1	6M	6M	6M	75	7.1	<-3SD	11.5	1	1	1	1	2	2	2	2	2	7.4	88	12	7.1	8.2	7.1	7.04	6.94	6.87	7.01	7.29	7.32			7.81	7.98	8.2			
HARISH	1	1Y 1M	M	3	2	1	2	1	2	1	7M	COMNT	7M	74	6	<-3SD	10.5	1	1	2	1	1	2	2	2	2	8.8	101	5	6	6.31	6.16	6.23	6.31												
KEERTHI	3	6M	F	2	2	2	2	2	2	1	4M	COMNT	4M	58	3.46	<-3SD	11.5	1	1	2	1	2	2	2	2	2	10.1	64	6	3.46	3.45	3.46	3.51	3.26	3.43	3.43	3.45										
SABARINATHAN	2	1Y	M	4	2	2	2	1	1	1	6M	6M	6M	66	5.3	<-3SD	12	1	1	2	1	2	2	2	2	2	11.1	96	6	5.3	5.74	5.3	5.5	5.45	5.53	5.55	5.74										
BINDU	3	4Y	F	3	2	2	2	1	1	2	5M	COMNT	5M	86	8.5	<-3SD	12.5	1	1	2	1	2	2	2	2	2	9.2	112	6	8.54	8.84	8.54	8.45	8.47	8.54	8.87	8.84										
SUJITHA	3	9M	F	2	1	2	2	2	2	1	3M	COMNT	3M	65.6	4.02	<-3SD	11	1	1	2	1	2	2	2	2	2	11	72	13	4.02	5.12	4.02	3.96	3.97	3.87	4.12	4.34	4.56	4.66	4.8	4.78	4.92	5.08	5.12			
PRIYA	2	2Y	F	2	2	2	2	1	1	2	4M	8M	4M	77.3	7.3	<-3SD	12	1	1	2	1	2	2	2	2	1	8.1	68	6	7.31	7.17	7.31	7.2	7	7.13	7.29	7.57										
TAMILARASAN	3	3Y3M	M	2	2	2	2	1	2	2	5M	1.5Y	5M	82.5	8.43	<-3SD	12	2	1	2	1	2	2	2	2	2	10.1	94	7	8.43	8.64	8.43	8.34	8.22	8.39	8.41	8.55	8.64									
PUSHPALATHA	1	7M	F	3	1	1	2	2	2	2	3M	CONNT	3M	65	5.4	<-3SD	11.8	2	1	2	2	2	2	2	2	2	10.1	78	5	5.4	5.74	5.4	5.36	5.56	5.65	5.73	5.77										
PRAVEEN	3	11M	M	2	2	2	2	2	2	2	6M	COMNT	6M	79.2	7.51	<-3SD	11.4	1	1	2	2	2	2	1	2	2	8.7	92	6	7.51	7.72	7.51	7.42	7.45	7.58	7.67	7.72										
HARISH	3	8M	M	2	2	2	2	2	2	2	5M	CONNT	5M	65	5.6	<-3SD	11	1	1	2	1	2	2	2	2	2	8.8	78	15	5.6	8.7	5.25	5.12	5.04	5.24	5.39	5.51	5.7	5.78	5.91	6.12	6.34	6.52	6.44	6.62	6.71	6.78
MOHANBABU	1	1Y3M	M	2	1	2	1	1	2	2	7M	7M	7M	73	6.7	<-3SD	13	1	1	2	1	2	2	2	2	2	10.8	89	6	7.1	7.4	7.5	7.4	7.44	6.95	7.22	7.4										
PAVITHRA	4	2Y	F	3	2	2	1	1	2	1	6M	CONNT	6M	82.9	8.5	<-3SD	12	2	1	1	1	1	2	2	1	1	4.4	89	13	8.5	8.56	8.5	8.4	8.21	7.89	8.41	7.75	7.68	7.88	7.98	8.15	8.38	8.45	8.56			
ANITHA	1+4	1Y1M	F	3	1	1	1	2	2	1	6M	CONNT	6M	75.5	6.25	<-3SD	8.5	1	1	1	1	2	1	2	1	1	7.5	43	6	6.25	6.66	6.25	6.11	6.2	6.34	6.53	6.66										
MADAN	3	4Y	M	2	2	2	2	2	2	1	7M	1Y	7M	86.5	9.5	<-3SD	12.3	1	1	2	1	2	2	2	2	2	8.5	65	7	9.5	9.81	9.5	9.41	9.48	9.54	9.7	9.81										
SUBHAVISHALAKSHMI	3	6M	F	3	1	2	2	2	2	1	5M	CONNT	5M	64	5.25	<-3SD	11	1	1	2	1	2	2	2	2	2	12	98	7	5.2	5.6	5.25	5.12	5.04	5.24	5.39	5.51	5.6									
NITHISH	3	2Y	M	2	2	2	2	2	2	1	6M	CONNT	6M	82.5	8.5	<-3SD	11.8	1	1	2	1	2	2	2	2	2	9.8	78	6	8.5	8.9	8.5	8.4	8.41	8.61	8.74	8.9										
GOPIKRISHNAN	3	3Y6M	M	2	2	2	2	2	2	1	5M	2Y	5M	85.5	9	<-3SD	12	1	1	2	2	2	2	2	2	2	8.3	64	5	9	9.65	8.9	9.25	9.57	9.65											
DENISHYA	3	1Y	F	2	2	2	2	2	2	1	6M	7M	6M	75	6.75	<-3SD	10	1	2	2	1	2	2	2	2	2	12.9	59	7	6.75	7.15	6.75	6.66	6.5	6.53	6.77	6.88	7.1									
MADHAN	3	4Y	M	2	2	2	2	2	2	1	8M	2Y	8M	94.1	11.1	<-3SD	11.7	1	1	2	2	2	2	2	2	2	8.5	96	6	11.1	11.65	11.1	11.08	11.15	11.34	11.59	11.65										
NITHYASHREE	1	1Y6M	F	2	2	1	2	2	2	2	6M	CONNT	6M	75	7	2TO -3SD	11	1	1	2	1	2	2	2	1	2	7.8	110	5	7	7.36	7	6.98	7.1	7.22	7.36										
REVATHY	3	2Y7M	F	2	2	2	2	2	2	1	6M	1Y	6M	82	9	<-3SD	12	1	1	2	1	2	2	2	2	2	11.9	63	5	9	9.35	9	8.96	9.09	9.29	9.35										
JHANSIRANI	3	8M	F	2	2	2	2	2	2	1	6M	CONNT	6M	65.6	6	<-3SD	11.5	1	1	2	1	2	2	2	2	2	7.6	74	6	6	6.2	6	5.96	5.89	6.09	6.19	6.2										
KHADARBASHA	3	1Y	M	2	2	2	2	1	2	1	5M	CONNT	5M	72	6.9	<-3SD	11.1	1	1	2	1	2	2	2	2	2	9.8	92	7	6.9	7.4	6.9	6.85	6.93	7.05	7.25	7.32	7.4										
KAVIBHARATHY	3	1Y	F	2	2	2	2	1	2	1	6M	CONNT	6M	71	6.5	<-3SD	11.2	1	1	2	2	2	2	2	2	2	8.7	65	5	6.5	6.78	6.5	6.35	6.4	6.53	6.57	6.78										
DEVIKA	2+1	1Y4M	F	2	2	1	2	1	1	1	5M	7M	5M	72.5	7.2	2TO -3SD	11	1	1	2	1	2	2	2	2	2	9.6	98	6	7.2	7.34	7.2	7.05	6.86	6.98	7.15	7.34										
RIHAN	3	8M	M	2	1	2	2	1	2	1	3M	CONNT	3M	61.4	4.25	<-3SD	10.5	1	1	2	1	2	2	2	1	2	8.4	65	6	4.25	4.59	4.25	4.12	3.96	4.21	4.36	4.59										
LAKSHMI	3	8M	F	2	2	2	2	2	2	1	6M	CONNT	6M	65.6	6	<-3SD	11.5	1	1	2	1	2	2	2	2	2	9.7	85	5	6	6.45	6	5.8	6.2	6.3	6.4										
SAILAKSHMI	3	2Y7M	F	2	2	2	2	2	2	1	6M	1Y	6M	82	9	<-3SD	12	1	1	2	1	2	2	2	2	2	11.9	69	7	9	9.65	9	8.85	8.74	9.12	9.36	9.58	9.69									
ANAND	3	1Y6M	F	2	2	2	2	2	2	2	6M	CONNT	6M	75	7	2TO -3SD	11	1	1	2	1	2	2	2	2	2	9.2	65	6	7	7.35	7	6.89	6.91	7.09	7.26	7.35									
CHANDAN	3	4Y	M	2	2	2	2	2	2	1	8M	2y	8M	94.1	11.1	<-3SD	11.7	1	1	2	1	2	2	2	2	2	9.5	64	6	9.5	9.81	9.5	9.36	9.4	9.59	9.69	9.81									
DIVYA	3	1Y	F	2	2	2	2	2	2	1	6M	7M	6M	75	6.75	<-3SD	10	1	2	2	1	2	2	2	2	2	12.9	91	6	6.75	7.15	6.75	6.64	6.66	6.88	6.98	7.15									
BALAKRISHNAN	3	3Y6M	M	2	2	2	2	2	2	1	5M	2Y	5M	85.5	9	<-3SD	12	1	1	2	2	2	2	2	2	2	7.5	84	7	9	9.72	9	8.89	9.11	9.22	9.44	9.68	9.72									
MAHESH	3	2Y	M	2	2	2	2	2	2	1	6M	CONNT	6M	82.5	8.5	<-3SD	11.6	1	1	2	2	2	2	2	2	2	9.2	62	6	8.5	8.92	8.5	8.35	8.54	8.69	8.77	8.92										
PORKODI	3	6M	F	3	1	2	2	2	2	1	5M	CONNT	5M	64	5.25	<-3SD	11	2	1	2	1	2	2	2	2	2	12	76	4	5.25	5.34	5.25	5.1	5.04	5.23	5.39	5.5										
NAVEEN	3	11M	M	2	2	2	2	2	2	2	6M	CONNT	6M	79.2	7.5	<-3SD	11.5	1	1	2	2	2	2	2	2	2	8.7	92	6	7.5	7.72	7.5	7.37	7.4	7.63	7.72	7.88										
SATHISH	3	8M	M	2	2	2	2	2	2	1	6M	CONNT	6M	65	5.4	<-3SD	11.6	1	1	2	1	2	2	2	2	2	8.8	68	13	5.4	6.1	5.4	5.36	5.56	5.65	5.73	5.91	5.94	5.55	5.69	5.72	5.77	5.92	6.1			
VIDYASHREE	1	7M	F	3	1	1	2	2	2	1	3M	CONNT	3M	65.2	5.48	<-3SD	11.2	1	1	2	2	2	2	2	2	2	9.8	95	6	5.48	5.63	5.48	5.36	5.55	5.65	5.73	5.91	5.94	5.69	5.72	5.77	5.92	6.1			
RANJITH	2	3Y3M	M	2	2	2	2	1	2	2	5M	1Y6M	5M	82.5	8.45	<-3SD	11.3	2	1	2	1	2	2	2	2	2	10.1	65	7	8.45	8.69	8.45	8.36	8.26	8.4	8.55	8.66	8.69									
PREETHI	1	9M	F	2	1	2	2	2	2	1	3M	CONNT	3M	65.6	4.09	<-3SD	11	1	1	2	1	2	2	2	2	2	11	72	12	4.09	4.3	4.09	3.98	3.97	4.12	4.34	4.56	4.66	4.8	4.78	4.92	5.08	5.12			
PRIYADARSHINI	3	2Y	F	2	2	2	2	1	2	2	4M	8M	4M	77.3	7.31	<-3SD	12	1	1	2	1	2	2	2	2	2	8.1	68	6	7.31	7.5	7.31	7.25	7.34	7.45	7.55	7.59	7.68	7.88	7.98	8.15	8.38	8.45	8.56			
DURGA	3	4Y	F	3	2	2	2	1	2	2	5M	CONNT	5M	86	8.51	<-3SD	12.5	1	1	2	1	2	2	2	2	2	9.2	87	6	8.51	8.84	8.51	8.45	8.47	8.54	8.87	8.84										
NIRMALA	3	1Y5M	F	2	2	2	2	1	2	1	6M	6M	6M	75	7.1	<-3SD	11.5	2	1	2	1	2	2	2	2	2	7.4	88	12	7.1	8.24	6.84	6.69	6.9	7.05	7.25	7.48	7.46	7.69	7.86	8.09	8.15	8.24			
SURESH	1	1Y1M	M	3	2	1	2	1	2	1	7M	CONNT	7M	74.1	6.2	<-3SD	10.5	1	1	2	1	2	2	2	2	2	8.8	101	4	6.2	6.34	6.2	6.12	6.1	6.2	6.3	6.34										
SENTHIL	3	6M	M	2	2	2	2	2	2	1	4M	9M	4M	58.1	3.47	<-3SD	11.5	1	1	2	1	2	2	2	2	2	10.1	64	6	3.47	3.63	3.47	3.31	3.26	3.42	3.43	3.57										
VIVEK	3	1Y	M	4	2	2	2	1	2	1	6M	6M	6M	66.2	5.31	<-3SD	12	1	1	2	1	2	2	2	2	2	11.1	69	7	5.31	5.73	5.31	5.3	5.5	5.4	5.53	5.55	5.73									
ARUN	3	4Y	M	2	2	2	2	2	2	1	7M	1Y	7M	86.5	9.5	<-3SD	12.3	2	1	2	1	2	2	2	2	2	10.1	65	6	9.5	9.8	9.5	9.3	9.5	9.5	9.6	9.8									
KARTHICK	1	1Y3M	M	2	2	1	2	1	2	2	7M	7M	7M	73	6.69	<-3SD	13	1	1	2	1	2	2	2	2	2	10.8	56	6	6.69	6.9	6.69	6.6	6.7	6.8	6.7	6.9									
BHARATHI	4	2Y	M	3	2	2	1	1	2	1	6M	CONNT	6M	83	8.42	<-3SD	12	2	1	1	1	2	2	1	2	1	4.1	89	7	8.42	8.54	8.42	8.39	8.23	8.2	8.39	8.55									
TRISHA	1+2+4	1Y1M	F	3	1	1	1	1	1	1	6M	CONNT	6M	75.5	6.25	<-3SD	8.5	2	1	1	1	2	1	2	1	1	7.5	43	9	6.25	6.41	6.25	6.11	6.2	6.34	6.53	6.66									
MONISHA	4	2Y	F	3	2	2	1	1	2	1	6M	CONNT	6M	82.9	8.5	<-3SD	12	1	1	1	1	2	2	2	1	1	4.4	89	10	8.5	9.1	8.5	8.4	8.3	8.2	8.3	8.5	8.76	8.85	9.1							
MAHESH	1	1Y3M	M	2	2	1	2	1	2	2	7M	7M	7M	73	6.7	<-3SD	13	1	1	2	1	2	2	2	2	2	10.8	69	6	6.7	7.1	6.7	6.56	6.6	6.8	6.9	7.1										
THIRUMURUGAN	3	4Y	M	2	2	2	2	2	2	1	7M	CONNT	7M	86.5	9.5	<-3SD	11.3	1	1	2	1	2	2	2	2	2	9.8	54	7	9.5	9.8	9.5	9.36	9.4	9.59	9.7	9.88										
JAIVARDHINI	3	1Y	M	4	2	2	2	1	2	1	6M	6M	6M	66	5.3	<-3SD	12	1	1	2	1	2	2	2	2	2	11.1	59	8	5.3	5.82	5.3	5.2	5.4	5.59	5.69	5.59	5.72	5.82									

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